

XVI INTERNATIONAL

CONGRESS OF ZOOLOGY

OTS PRICE

XEROX

MICROFILM

\$

\$

1,0075  
1,50 mfr

Proceedings VOLUME 1  
CONTRIBUTED PAPERS

FACILITY FORM 602

N 64 33512

(ACCESSION NUMBER)

334

(PAGES)

10-59306

(NASA CR OR TMX OR AD NUMBER)

(THRU)

(CODE)

(CATEGORY)

WASHINGTON / 20-27 AUGUST 1963

# **XVI INTERNATIONAL CONGRESS OF ZOOLOGY**

**WASHINGTON**

**20-27 AUGUST 1963**

## **PROCEEDINGS**

*Edited by*  
*John A. Moore*

## **VOLUME 1**

**Contributed Papers**



*Published by the*  
**XVI INTERNATIONAL CONGRESS OF ZOOLOGY**  
*Washington D. C.*

The Proceedings of the XVI International Congress of Zoology consists of six volumes. Volumes 1 and 2 contain abstracts of Contributed Papers. Volumes 3 and 4 contain abstracts of papers presented in the Specialized Symposia. Volumes 1, 2, 3, and 4 are being printed before the Congress begins from copy supplied by the authors. Volume 5 contains a general account of the Congress and Volume 6 contains the papers of the Plenary Symposia. Volumes 5 and 6 will be printed and distributed after the Congress.

This Volume, number 1, is not covered by copyright. Thus there are no legal restrictions on reproduction of any of its contents. It is requested, however, that the permission of individual authors be secured.

XVI  
INTERNATIONAL CONGRESS OF ZOOLOGY

Held at

Washington  
20-27 August 1963

By Invitation of

National Academy of Sciences  
National Research Council

President

Alfred S. Romer

Vice Presidents

Umberto D'Ancona  
Jean G. Baer  
Enrique Beltrán  
John Berrill  
L. C. Birch  
Pierre-P. Grasse

Sven Hörstadius  
Libbie H. Hyman  
H. J. Muller  
Ye. N. Pavlovskii  
Eduardo De Robertis  
Owain W. Richards

B. R. Seshachar  
E. J. Slijper  
George G. Simpson  
Nikolaas Tinbergen  
Tohru Uchida  
C. M. Yonge

Organizing Committee

E. J. Boell  
John T. Emlen, Jr.  
Ernst Mayr  
Thomas Park

C. L. Prosser  
Emil Witschi  
Harold J. Coolidge  
Carl L. Hubbs  
James A. Oliver

John R. Preer  
Curtis W. Sabrosky  
H. Burr Steinbach  
Paul Weiss

Secretary General

Gairdner B. Moment

Program Chairman

John A. Moore

Treasurer

Alexander Wetmore

Finance Chairman

Gerard Piel



## **Sponsoring Societies**

**American Society of Zoologists**

**American Institute of Biological Sciences**

**American Ornithologists' Union**

**American Society of Ichthyologists and Herpetologists**

**American Society of Mammalogists**

**American Society of Parasitologists**

**Ecological Society of America**

**Society of Economic Paleontologists and Mineralogists**

**Society of General Physiologists**

**Society of Protozoologists**

**Society for the Study of Development and Growth**

**Society for the Study of Evolution**

**Society of Systematic Zoology**

**The Entomological Society of America**

**The Paleontological Society**

**Wildlife Society**

## Contents

1A. INVERTEBRATE ZOOLOGY	1
<p>A Successful Method for Rearing Leafhopper Vectors of Plant Viruses under Aseptic Conditions. Jun Mitsuhashi and Karl Maramorsch</p>	3
<p>La Biologie du Genre <u>Empicoris</u> Wolff. Hemiptera Heteroptera Reduviidae (<u>Emesinae</u> <u>stenolaemini</u>). Paul Dispos</p>	4
<p>The Antigenic Properties and the Antibody Responses of the Hemolymph of the Large Milkweed Bug, <u>Oncopeltus fasciatus</u> Dorothy Feir and M. Antoinette Walz</p>	5
<p>Cuticular Pigments in Orthoptera. Semahat Geldiay</p>	6
<p>La Régulation Thermique chez les Vespides. Maurice P. Vuillaume</p>	7
<p>Contribution à l'Etude de la Morphogenese du Système Nerveux Central des Insectes. Gaston Richard</p>	8
<p>Rasgos Fundamentales de la Organización y Desarrollo Larval de los Mutelidos Americanos. Argentino A. Bonetto</p>	9
<p>Niveau de Rupture de la Patte des Insectes. Bernard Possompès</p>	10
<p>Sur l'Evolution Biologique dans le Groupe des Cynipides Gallicoles d'Europe Occidentale (Hymenopteres, Cynipoidea). R. Folliot and P. L. Maillet</p>	11
<p>The Chemistry and Physiology of the Brain Hormone. Masatoshi Kobayashi</p>	12
<p>Rate of Incorporation of Amino Acids into the Web Proteins of the Spider <u>Araneus diadematus</u> Cl. David B. Peakall</p>	13
<p>Observations on the Biology of <u>Hypoaspis aculeifer</u> Canestrini, 1885 (Acarina: Laelaptidae), a Mite Apparently New to North America. D. Keith McE. Kevan and G. D. Sharma</p>	14

The Cave Opilionids of the United States. Clarence J. Goodnight and Marie L. Goodnight	15
Integument of Tunicata. Jean Eug. Aug. Godeaux	16
Genetic Control of Pigmentation in <u>Botryllus schlosseri</u> . Armando Sabbadin	17
Endocrine Secretions and Metals in the Generation of New Tissue in the Genus <u>Eudistoma</u> . Estes Potter Levine	18
1B. INVERTEBRATE ZOOLOGY.	19
Further Studies on the Cytology and Life History of the <u>Zooxanthella</u> , <u>Symbiodinium microadriaticum</u> (Freudenthal). Hugo D. Freudenthal and John J. Lee	21
Life Cycle and Morphology of a New Polymorphic Allogromiid. John J. Lee and Stanley Pierce	22
Ultrastructure du Tissu Larvaire des Démosponges. Claude Lévi	23
Two Phylogenic Lines in the Coelenterates from the Viewpoint of their Symmetry. Tohru Uchida	24
The Contraction Burst Pacemaker System in Hydras. C. B. McCullough	25
Sur la Phylogénèse des Siphonophores. Eugène Leloup	26
Le Colloblaste des Cténophores: Ultrastructure, Signification. Raymond Hovasse et Pierre de Puytorac	27
Digestion in Triclad Turbellaria. Joseph Brian Jennings	28
Some Hydrolytic Enzymes in Two Digenetic Trematodes. David W. Halton	29
Considerations sur la Reproduction des Sangsues du Genre <u>Trocheta</u> . Roger Husson	30
Données Nouvelles sur la Reproduction de Coccidies Extracellulaires Parasites d'Annelides polychètes. Emile Vivier	31

Induction of Males in a Usually Parthenogenetic Rotifer. Helene Nathan Guttman and Airmlee D. Laderman	32
The Female Urogenital Organs of <u>Priapulus caudatus</u> Lamarck. Arne Nørrevang	33
Protraction and Retraction of Ophiuroid Tube-feet. Jeremy Woodley	34
Factors Causing Variation in the Statoblasts in Lophopodella. Shuzitu Oda	35
Biology of Endoparasitic Turbellarians of the Aberrant Family, Fecampidae. Aage Møller Christensen. No Abstract.	
1C. INVERTEBRATE ZOOLOGY.	37
Observations on the Snails Drilling Young Bivalves of <u>Tapes philippinarum</u> . Ki Chul Choi	39
The Filter Feeding Mechanism of Bivalves, a Constantly Working Engine or a Controlled Behavioral Activity? Carl Schlieper	40
Etude Expérimentale de la Régénération du Tentacule Oculaire chez <u>Arion rufus</u> . Monique Chétail	41
The Replacement of the Molluscan Radula. Norman W. Runham	42
Structure and Function in the Digestive Gland of a Marine Snail, <u>Aglaja diomedea</u> Bergh (Opisthobranchia-Cephalaspidea). J. J. Gonor	43
Shell Structure of Fossil and Recent Patelloid Archaeo- gastropods. Copeland MacClintock	44
The Origin and Evolution of the Molluscs of the Black Sea. Alexandru V. Grossu	45
Morphological and Phylogenetic Considerations on Brachipoda, Based on Anatomical Studies about Shell and Body-wall Formations. Andres de Haro	46
Les Sillons de la Carpace des Décapodes Macroures et l'Evolution des Segments Antérieurs. Sylvie Secretan	47
The Pericardial Sacs of Terrestrial Crabs. Dorothy E. Bliss	48

Phyletic Relationships within the Paguridea (Crustacea, Anomura) Supported by Larval Studies. Anthony J. Provenzano, Jr.	49
The Relation of Egg Production to Food Uptake in <u>Tigriopus brevicornis</u> . G. W. Comita	50
The Status of Entocytherid Ostracod Research in the United States and Mexico. C. W. Hart, Jr.	51
(Phylogenetic Relations in Copepoda parasitica). A. P. Markevitch	52
On the Mallophaga of Egypt. Mahmoud Hafez and M. H. Madbouly	53
1D. ROLE OF ECTOCRINES IN INTERACTIONS OF AQUATIC INVERTEBRATES.	55
Oyster Nutrition and Organic Materials. Albert Collier	57
The Chemical Basis of Substrate Selection by Certain Marine Invertebrate Larvae. Dennis John Crisp	58
The Role of Ectocrines in Animal Associations. Demorest Davenport	59
Metabolic Trends Associated with Succession in Phytoplankton. Robert Johnston (To be read by I. M. Sandeman)	60
The Swimming Behavior of the Sea Anemone <u>Stomphia coccinea</u> . Elaine Robson	61
A Sea Anemone, a Hermit Crab and a Shell---an Ecological Triangle. D. M. Ross and L. Sutton	62
Interaction of a Gastropod Veliger and Bottom Sediment Resulting in Metamorphosis. Rudolf S. Scheltema	63
Population Regulation by Ectocrines in <u>Cura formanii</u> (Turbellaria). Bassett Maguire, Jr.	64
1E. BIOLOGY OF CEPHALOPODS.	65
Information Obtained by Using Squid Predators as Samplers. Malcolm R. Clarke	67
The Distribution and Abundance of the Epipelagic Decapod (Cephalopoda) Larvae in the California Current. John A. McGowan and Takashi Okutani	68

Distribution of Oceanic Cephalopods off Oregon, U. S. A. William G. Percy	69
Cephalopods of the San Pedro and Catalina Basins. Gary Hendrix	70
Cephalopod Locomotion. Anna M. Bidder	71
Biology of <u>Loligo opalescens</u> . W. Gordon Fields	72
Observations on the Behavior of <u>Octopus</u> . F. G. Wood, Jr.	73
Function and Comparative Morphology of the Funnel Organ in Cephalopods. Gilbert L. Voss	74
Comparative Internal Anatomy of <u>Vampyroteuthis infernalis</u> . Richard E. Young	75
Developmental Analysis of the Cephalopod Embryo. John M. Arnold	76
The Dicyemid Mesozoa. Robert B. Short and Raymond T. Damian	77
The Process of Ammonia Excretion in an Octopus. W. T. W. Potts and A. W. Martin	78
1F. MUCUS IN INVERTEBRATES.	79
Mucus in Invertebrates---Introductory Remarks. Sophie Jakowska	81
Cytological and Cytochemical Observations on the Mucous Gland Cells of <u>Convoluta convoluta</u> . K. J. Pedersen	82
The Role of Glycoproteins in Egg-shell Formation of Trematodes and Cestodes. J. A. Clegg	83
Histochemical Studies on the Regeneration of Mucus-producing Cells in the Integument of the Garden Slug. John A. Arcadi	84
The Effect of Temperature and Photoperiod on Mucus Secretion in a Slug, <u>Limax flavus</u> . Earl Segal	85
Mucus of the Giant Slug, <u>Ariolimax columbianus</u> (Gould). Robert E. Taylor	86
A Comparative Study of the Integumentary Mucous Cells of Ophiuroids. A. R. Fontaine	87
Mucus in Feeding Mechanisms of some Crustacea. Erik Dahl	88

The Presence of Mucopolysaccharides in the Hepatopancreas of the Isopod, <u>Armadillidium vulgare</u> . Harrison R. Steeves, III	89
Mucopolysaccharides in some Marine Invertebrates. Idelisa Bonnelly de Calventi. No abstract.	
2A. MARINE ZOOLOGY.	91
Marine Fouling Communities of Rhode Island. Donald J. Zinn, Richard D. Wood and Harold Berkson	93
Strontium Scavengers in Marine Plankton: the Acantharia. Bruno Schreiber	94
Recent Experimental Evidence on the Nutritional Value of Phytoflagellate Types to a Calanoid Copepod. David L. Urry	95
Biology of some Pogonophora. Alan J. Southward and Eve C. Southward	96
(On the Vertical and Geographical Distribution of Pogonophora). V. Ivanov Artemii	97
Propagation of the Common Starfish, <u>Asterias forbesi</u> , in Long Island Sound during a Twenty-five Year Period. Victor L. Loosanoff	98
Ultrastructure de la Sécrétion Cémentaire du Tube chez <u>Sabellaria alveolata</u> (L.), Annélide Polychète. Jean Louis Vovelle	99
Origine des Nouveaux Muscles à Structure Hétéronéréidienne. René Defretin	100
Larval Development of <u>Nereis diversicolor</u> in Relation to Regional Salinity. Ralph I. Smith	101
The Problem of " <u>Eucalanus elongatus</u> Dana." Bui Thi Lang	102
The Dynamics of Mixed Populations of Natant Decapod Crustacea in the North Sea. J. A. Allen	103
Studies on the Decapod Crustacea Commensal with Branching Corals of Queensland, Australia. Wendell K. Patton	104
Distribution of Pink Shrimp Larvae ( <u>Penaeus duorarum</u> Burkenroad) in South Florida. Albert C. Jones	105

Observations on the Histology of the Eyes of Euphausiid Crustaceans. Elizabeth M. Kampa, Brian P. Boden, and Bernard C. Abbott	106
A Comparative Study of Arctic and Antarctic Pycnogonida. Joel W. Hedgpeth	107
2B. MARINE ZOOLOGY.	109
The Reproductive Cycle of the Antarctic Asteroid, <u>Odontaster validus</u> Koehler. J. S. Pearse	111
La Morphologie des Pieces Buccales Chez les Splanchnotrophidae (Copepodes Parasites de Mollusques). Lucian Laubier	112
Population Studies on a Tropical Ascidian. Ivan Goodbody	113
The Effect of Temperature on the Incubation Time, Development and Growth of Pacific Sardine ( <u>Sardinops caerulea</u> Girard) and Northern Anchovy ( <u>Engraulis mordax</u> Girard) Embryos and Larvae. Reuben Lasker	114
Systematics and Ecology of Indo-Pacific Fishes Recently Established in the Eastern Mediterranean. Adam Ben-Tuvia	115
Visual Axis and Accommodation of Fish Eyes. Tamotsu Tamura	116
Diving of <u>Cyclococcolithus fragilis</u> (Lohm) Its consequences for Life Cycle in Warm Seas. Francis Bernard	117
Transport of Nutrients in Echinoderms. A. Farmanfarmaian	118
3A. PARASITOLOGY.	119
A Ciliate Protozoan of Whale-lice. John L. Mohr, Hitoshi Matsudo, and Yuk M. Leung	121
Ciliate Protozoa as Inquilines of the Echinoidea. Jacques Berger	122
Deux Nouvelles Opalines de l'Ouest Africain. Charles Boisson	123
Durability of <u>Entamoeba invadens</u> in Axenic Serial Cultures. Norman R. Stoll	124
Some Facets of Host-parasite-drug Interactions in Amebic Infections. Brahma S. Kaushiva	125
Distribution and Development of <u>Leishmania donovani</u> Leptomonads in Laboratory and Infections of <u>Phlebotomus papatasi</u> and its Application to Kala-azar Transmission in the Sudan. Donald Heyneman	126



Transformation in <u>Trypanosoma equiperdum</u> . Yost U. Amrein	127
The Reduviid Vectors of Chagas' Disease in Panama. Alan C. Pipkin	128
Strain Variation in <u>Trichomonas vaginalis</u> . Robert Samuels	129
Studies on the Haematozoa of the Reptiles of West Pakistan. I. A <sup>1</sup> Haemogregarine from Snake <u>Echis carinatus</u> of the Sind Region of West Pakistan. Ahmed Mohiuddin	130
The Course of Antibody Production in Experimental <u>Eimeria</u> <u>bovis</u> Infections in Calves as Demonstrated by Fluorescent Staining. Ferron L. Andersen, Datus M. Hammond, and Paul B. Carter	131
Systematics, Taxonomy and Nomenclature of the Trematoda. Horace W. Stunkard	132
A Review of the Attachment Mechanisms of Monogenean Parasites. Jack Llewellyn	133
Population Studies on the Genus <u>Ribeiroia</u> Travassos, 1939 (Trematoda: Cathaemasiidae). David F. Mettrick	134
Factors in Host Resistance to the Dwarf Tapeworm, <u>Hymenolepis</u> <u>nana</u> . Clarence J. Weinmann	135
Patterns of Penetration and Development of Two Xiphidiocercariae from the Philippines. Carmen C. Velasquez	136
3B. PARASITOLOGY.	137
The Gold of the Golden Nematode of Potatoes. Conrad Ellenby	139
Patterns of Specificity for Nematode Parasites of Insects. H. E. Welch	140
Observations on the Blood-fluke of <u>Merluccius merluccius</u> , an Important Food Fish. Sheila Willmott	141
Chemical Attraction of <u>Schistosoma mansoni</u> Miracidia. Austin J. MacInnis	142
Relationships between <u>Heterakis gallinarum</u> (Nematoda) and <u>Histomonas meleagridis</u> (Flagellata) in Gallinaceous Birds. Holger Madsen	143
<u>Onchocerca volvulus</u> : Nomenclatura, Taxonomía y Morfología. Francisco J. Aguilar	144

La Transmission Héritaire des Bactéries Symbiotiques chez les Lygaeidae Vivipares (Heteroptera). Jacques Carayon	145
Contribution à l'Etude des Parasites et Commensaux de <u>Gibbula umbilicalis</u> da Costa. Lucie Arvy	146
The Evolutionary History of a Copepod Now Parasitic in a Mollusc. J. P. Harding	147
Ecology of Parasites of some Pacific Gobies. Elmer R. Noble	148
Les Parasites des Chiroptères. Rôle Epidémiologique chez les Animaux et l'Homme, au Katanga. Michel Anciaux de Faveaux	149
The Immunology of Venomous Animals in Israel. Aharon Shulov	150
(Parasites of Gallinaceous Birds). G. S. Kasimov	151
Some Possible Methods for the Transferral of Avian Nasal Mites. Kerwin E. Hyland and Lee E. TerBush	152
4. VERTEBRATE ZOOLOGY.	153
The Origin of the Vertebrate Head. Sydney Smith	155
A New Method for the Determination of the Total Volume of Blood Vessels in Various Tissues and Organs. Henryk Szarski	156
On the Structure and Evolution of the Accessory Respiratory Organs of some Indian Fishes. A. B. Misra	157
Reproductive Behavior Patterns and Functional Anatomy of some American Oviparous Cyprinodont Fishes. Neal R. Foster	158
Las Especies del Género <u>Cynolebias</u> Steindachner, 1876. Raúl Vaz-Ferreira, Blanca Sierra-de-Soriano, and Susana Scaglia-de-Paulette	159
Un Nouveau Type de Structure chez un Clupeoide du Bassin du Congo (Teleosteens isopondyles). Max Poll	160
The Homologies of the Labyrinthodont Centrum. A. L. Panchen	161
Egg Capsule Structure in the Amphibia. Stanley N. Salthe	162
Urea Levels and Bladder Water Utilization during Dehydration of Toads. Rodolfo Ruibal	163

Phylogenetic and Ecological Significance of Body Fluid Partitioning in Amphibia. Thomas B. Thorson	164
<u>Diadectes</u> and the Chelonia. Everett C. Olson	165
Photoregulative and Innate Factors in the Reproductive Cycles of an Equatorial Sparrow. Alden H. Miller	166
The Skin Structure in Wild Artiodactyla of the USSR Fauna. Wladimir Sokolov	167
On the Functional Significance of Pinnate Muscles. Carl Gans and Walter J. Bock	168
A Relationship between Thymus and Lymph Node Growth in the Hamster. David Shepro, Nora Kula, and Linda Poole	169
5. PALEONTOLOGY.	171
Ordovician Polychaete Jaw Apparatuses from Poland. Zofia Kielan-Jaworowska	173
Mollusks from Wisconsinan (Pleistocene) Ice-contact Sediments of the Missouri Coteau in Central North Dakota. S. J. Tuthill, Lee Clayton, and F. D. Holland	174
Form and Function in an Early Paleozoic Protobranch Bivalve. A. Lee McAlester	175
The Hyomandibular Problem in Placoderm Fishes. T. Stanley Westoll	176
The Paired Fins and Axial Skeleton of the Crossopterygian Fish <u>Eusthenopteron</u> . T. Stanley Westoll and Shiela M. Andrews	177
(Problems of the Origin of Saurapsid and Therapsid Reptiles.) L. P. Tatarinov	178
On the Comparative Anatomy of the Molars of Higher Primates. Georges Vandebroek	179
(New Data on the Fauna of the Lower Zones of the Upper Permian of the USSR). Peter Tschudinov	180

6A. SYSTEMATICS	181
Les Combinaisons Multidimensionnelles de Caractères Anatomiques Quantitatifs. Pierre Jolicoeur	183
Relative Growth Patterns as Taxonomic Characters in Arthropoda. Ryuichi Matsuda	184
Distribution of Amino Acids and Related Compounds in Animals in Relation to their Taxonomy. B. R. Seshachar, K. N. Saxena and J. R. Gandhi	185
Systematics of <u>Spirostomum</u> (Class Ciliata). Harold E. Finley, Nathaniel Boggs and Pearl T. Crump	186
Valeur Systématique des Caractères Mineralogiques de la Coquille dans Certaines Familles de Prosobranches. Michel Petitjean	187
Systematics of Gastropod Molluscs of the Family Conidae. Alan J. Kohn	188
Quelques Considérations sur le Faune des Isopodes Terrestres de la Roumanie. V. Gh. Radu	189
A Classification and Phylogeny of the Chtamalidae (Cirripedia: Thoracica). Victor A. Zullo	190
Sinopsis Histórica de los Estudios sobre Syrphidae (Diptera) Chilenos. María Etcheverry	191
<u>Aegyptococcus</u> , a New Genus for <u>inermis</u> of Hall (Homoptera: Coccoidea-Pseudococcidae). Yehia M. Ezzat	192
A Review of the Family Oripodidae (Acarina: Oribatei). Tyler A. Woolley	193
Ratification de la Sinonimia de <u>Latrodectus curacaviensis</u> (Muller, 1776)-- <u>Latrodectus mactans</u> (Fabricius, 1775) (Aranaeae). Berta S. Gerschman de Pikelin and Rita D. Schiapelli	194
Validité d'une Distinction Spécifique entre les Deux Acipenserides: <u>Acipenser sturio</u> L. d'Europe et <u>Acipenser oxyrhynchus</u> Mitchell d'Amerique du Nord. Etienne Magnin	195
Approach to a Biochemical Taxonomy through Screening of Bio-genic Amines and Polypeptides in the Skin of South American Amphibians. Vittorio Erspamer and Jose M. Cei	196

Variation in the Snapping Turtle <u>Chelydra serpentina</u> : a Study in Quantitative Systematics. Robert C. Feuer	197
7. ZOOGEOGRAPHY	199
Zoogeographical Relationships and Post-glacial Dispersal of Littoral Marine Invertebrates of Eastern Canada. Edward Lloyd Bousfield	201
On the Origins and Relationships of the Arctic Ocean Abyssal Mollusk Fauna. Arthur H. Clarke, Jr.	202
Temperature and the Geographical Distribution of Lugworms (Arenicolidae, Polychaeta). G. P. Wells	203
Barriers between Tropical Pacific and Indian Ocean Euphausiid Species (Zooplankton, Crustacea). Edward Brinton	204
Evolution and Dispersal of Contemporary Vertebrates in Eastern North America. Joseph H. Waters	205
The Post Glacial Dispersal of American Caribou. A. W. F. Banfield	206
Composition and Origin of the Tenebrionid Fauna of North Western South America and the West Indies. Giorgio Marcuzzi	207
Zur Geographischen Verbreitung der Gattung <u>Formica</u> in Europa. Karl Gösswald	208
(Contribution to the Knowledge of Vertical Zonation in Insects in Mountain Regions: Georgian SSR Taken as an Example). David N. Kobakhidze	209
Phylogenetic Relationships and Geographical Distribution of some Oribatei (Acari) from Antarctica. John A. Wallwork	210
Wallacea and Insular Fauna of Millipedes. Yu-Hsi Moltze Wang	211
The Systematics, Origin and History of Distribution of the Eurasiatic and North American Species of <u>Perca</u> , <u>Lucioperca</u> and <u>Stizostedion</u> . A. N. Svetovidov	212
Zoogeographical Distribution of the <u>Otididae</u> with Special Reference to Indian Species. R. S. Dharmakumarsinhji	214
L'Origine et la Distribution Géographique de la Faune de la République Populaire Roumaine. Mihail A. Ionescu	215

The Southernmost Occurring Animals. J. Linsley Gressitt	216
9A. ECOLOGY.	217
Adaptations Thermiques de Quelques Protozoaires Libres et Parasitiques. Georges I. Poljansky	219
Antarctic Foraminiferal Zonation. Orville L. Bandy and Ronald J. Echols	221
On the Ecology of Hydromedusae. Marta Vannucci	222
The Ecology of Co-occurring Congeneric Pinworms in the Tortoise, <u>Testudo graeca</u> . Gerhard A. Schad	223
Ecologie des Sédiments Meubles Intertidaux, Peuplements en Microfaune et Macrofaune. J. Renaud-Debyser and B. Salvat	224
(Soil Erosion and its Influence on Earthworms). O. P. Atlavinite and A. I. Pajarskajte	225
The Effect of Salinity on the Temperature Tolerance of Eggs and Larvae of some Lamellibranch Mollusks. Harry C. Davis	226
Reproduction and Larval Development of the New England Clam Drill, <u>Polinices duplicatus</u> (Say) (Naticidae: Gastropoda). James E. Hanks	227
Zur Umweltabhängigkeit des Holz-Amphipoden <u>Chelura terebrans</u> Philippi (Amphipoda, Cheluridae). Helmut Kühne	228
(Changes of the Entomofauna of Semi-deserts of Central Asia under the Influence of Irrigation). Vladmir V. Yakhontov	229
Temperature Adaptation of <u>Drosophila</u> . Alice S. Hunter	230
Ecological Studies of Certain Neotropical Drosophilidae. S. B. Pipkin	231
Population Energetics of Meadow Spittlebugs ( <u>Philaenus spumarius</u> L.) as Affected by Migration and Habitat. Richard G. Wiegert	232
The Dependence of Productivity on the Size of Medium in Self-ranging, Confined Populations of <u>Paramecium</u> , <u>Tribolium</u> , and <u>Mus</u> . Kazimierz Petrusiewicz	233

First Benthic Studies in "Flamingo" Bay. Liliana Forneris	234
9B. ECOLOGY.	235
Soil Mites, Equivalent for the Northern and Southern Hemispheres. John Balogh	237
Respiratory Metabolism of <u>Leiobunum rotundum</u> (Latr.) (Phalangiida). John Phillipson	238
Temperature Responses of the Parasitoid, <u>Praon palitans</u> , and its Aphid Host, <u>Therioaphis maculata</u> . P. S. Messenger and D. C. Force	239
Predatory Insects as Density Dependent Mortality Factors. George C. Varley and G. R. Gradwell	240
Les Caractères "Mimétiques" au Service de la Protection Contre les Radiations Solaires Nocives chez Certains Insectes et chez d'Autres Espèces Animales. Lazar Jovančić	241
Quality of the Spawning Bed as it Relates to Survival and Growth of Pink Salmon Embryos and Alevins and Time of Fry Emergence. William J. McNeil	242
Nitrogen Turn-over in an Estuarine Fish Population. Rezneat M. Darnell	243
Extinct, Rare, and Endangered American Freshwater Fishes. Robert Rush Miller	244
Influence of Freshwater Environment on Survival of Coho Salmon. William A. Smoker	245
The Fate of Introduced Freshwater Fish in Malaya. Desmond S. Johnson and Maureen H. H. Soong	246
Comparative Ecology of Four Sympatric Dendrobatid Frogs in Northern Venezuela. Frederick H. Test	247
Some Aspects of the Water Economies of Nine Species of Amphibians. William D. Schmid and James C. Underhill	248
A Spectrophotometric Analysis of Color in Living Reptiles. Kenneth S. Norris	249
Tolerancia en Grupos Biespecificos de Pinnipedios. Raúl Vaz-Ferreira and Blanca Sierra-de-Soriano	250

Ecologia de Vertebrados en Aguas Dulces Temporales del Uruguay. Raúl Vaz-Ferreira, Blanca Sierra-de-Soriano and Juan Soriano-Senorans	251
9C. ECOLOGY.	253
Species Composition and Populations of Sea Bird Colonies at Cape Thompson, Alaska. L. G. Swartz	255
Interspecific Diet Differences in a Group of Sympatric Anatinae. P. J. S. Olney	256
Can Food Control the Numbers of Small Rodents in the Deciduous Forest? Wladyslaw Grodzinski	257
Analysis of Reproduction in a Black-tailed Jack Rabbit Population. Norman R. French	258
(The Populations of Desert Rodents and their Dynamics). N. P. Naumov	259
Some Considerations On Animal Synanthropy. Dalibor Povolný	260
(A General Analysis of the Morphological Peculiarities of the Populations of Terrestrial Vertebrata). Stanislav Schwarz	262
Dynamics of an Island Population of Rhesus Monkeys. Carl B. Koford	263
Metabolism of some Alaskan Lagomorphs. Eleanor G. Viereck	264
Predation in the Lemming Cycle at Barrow, Alaska, 1951-63. Frank A. Pitelka	265
Mammal Distribution and its Relationships to the Plant Cover. Beatrica Dulic	266
Introduction of Exotic Species of Mammals. E. Raymond Hall	267
A Theory of Small Mammal Index Trapping. Ian Linn	268
Psychophysiological Response to the Level of Environmental Stimulation. Bruce L. Welch	269



SCIENTIFIC DEMONSTRATIONS.

1. Variability in the Trematode, Orientocreadium batrachoides  
Tubangui, 1931 (Trematoda: Allocreadiidae). Mary  
Beverley-Burton 271
2. Response of Tribolium confusum to Radiations and other  
Stresses. H. S. Ducoff and G. C. Bosma 273
3. Mechanisms of Anoxic Resistance of the Newborn Mammal.  
Laurence R. Fitzgerald 274
4. Contribution à la Physiologie du Poisson Dipneuste Protopterus.  
R. Godet 275
5. A Brief Description on 'Illustrated Encyclopedia of the Fauna  
of Korea.' Yung Sun Kang 276
6. Demonstration of Living Bivalved Gastropods. Siro Kawaguti 277
7. Humidity Responses and the Survival of Aquatic Isopods and  
Amphipods in the Air. Kari Lagerspetz 278
8. Use of Growth Rate of Reef Corals to Study Past Climate  
and Follow out the Course of Polar Wandering with  
Accompanying Drift of Continents. Ting-Ying H. Ma 279
9. Protective Variation Illustrated in the Clam Donax variabilis  
Say and the Brittlestar Ophiopholis aculeata (L.). Gairdner  
B. Moment 280
10. Application d'une Methode de Perfusion Physiologique à  
l'Etude Anatomique de la Vascularisation Placentaire chez  
les Rongeurs et les Bovides (Démonstration Scientifique).  
Maurice Panigel 281
11. Recherches sur le Système Nerveux des Insectes. G. Richard 282
12. Transfer to Descendency of Alterations Induced in the White  
Leghorn by Repeated Injections of Heterologous Blood. J.  
Stroun, L. Stroun-Guttières, J. Rossi, and M. Stroun 283
13. The Millipedes and Centipedes of Taiwan, China. Yu-hsi  
Moltze Wang 284

14. High School Curriculum Materials Produced by the  
Biological Sciences Curriculum Study, Established by  
the American Institute of Biological Sciences and Fi-  
nanced Primarily by the National Science Foundation.  
Arnold B. Grobman and Bentley Glass 286

PAPERS PRESENTED BY TITLE 287

- Synapses-examinations on the Heart of Vagotomised European  
Pond Tortoises. Ambrus Abrahám 289

- L'Influence de la Temperature sur l'Existence et la Dis-  
persion de Bombina variegata(L.). L. Berner 290

- Remarques sur les Nematodes Parasites de Vertebres Malgaches.  
Alain G. Chabaud 291

- Endoparasitism in Malayan Forest Mammals. Frederick L.  
Dunn 292

- Herkunft und Entwicklung des Faunistischen Steppenkomplexes  
der Terrestrischen Wirbeltiere in der Rumanischen Volksre-  
publik. Martin Hamar 293

- On the Dynamics of Zoocoenoses of River Valleys. Ladislaus  
Havranek 294

- Investigations of the Reversionary Trends of some Palearctic  
Birds. L. Horvath 295

- Integration, Adaption and Progression-regression as Systemic  
Unity. Gabriel Kolosváry 296

- Endocrine Influences on Protein and Fat in the Hemolymph of  
the Cockroach Periplaneta americana. Maya Menon 297

- Disease in Laboratory Hamsters. Jer K. Mody and Sunanda V.  
Gothoskar 298

- The Lymphoid Organ as an Endocrine Gland of the Scorpion  
Heterometrus scaber. K. K. Nayar 299

- Observations Biologiques sur les Diploures Japygides. Jean  
Pages 300

- Data on the Physiological Basis for the Rhythmic Activity of  
Fresh-water Mussel's Larvae. János Salánki and Elemér  
Lábos 301

An Attempt at Analysing the Course Taken by the Process Exerted by Overcrowding on the Reproduction of a Population of <u>Calandra granaria</u> L. Henryk Sandner	302
Maintenance of Larval Tapeworms ( <u>Taenia crassiceps</u> ) in a Chemically Defined Medium. Angela E. R. Taylor	303
Origin of the Rhopalocera Stem of the Lepidoptera. Norman B. Tindale	304
(Various Forms of Physiological Testing in Insects of Condi- tion of their Biological Progress). R. S. Ushatinskaya	305
INDEX	307

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

1A. INVERTEBRATE ZOOLOGY

A SUCCESSFUL METHOD FOR REARING LEAFHOPPER VECTORS  
OF PLANT VIRUSES UNDER ASEPTIC CONDITIONS \*

Jun Mitsuhashi and Karl Maramorosch  
Boyce Thompson Institute for Plant Research, Inc.  
Yonkers 3, New York

A method was developed for the axenic (free from fungi and bacteria) rearing of leafhoppers (Cicadellidae). The following species of vectors of plant viruses were successfully reared: Macrosteles fascifrons Stål, Dalbulus maidis DeLong & Wol., Agalliopsis novella Say, Agallia constricta (van Duzee). Impregnated females were confined to limited areas of plants for oviposition. A few days later, deposited eggs were excised, fastened to strips of wax paper, surface-sterilized with 0.1% Hyamine solution, and placed in test tubes containing plants grown on agar media from sterilized seed. In all four species the developmental cycle was completed in approximately the same period as under natural conditions. After mating, axenically reared females deposited eggs not only in living plants but also on glass walls of the containers. The second, axenically born, generation was transferred aseptically to larger containers. To prevent excessive condensation of water vapor and accidental drowning of insects, bags with silica gel were suspended in the containers. Axenically reared leafhoppers are now being used for the study of virus-vector relationships and for providing suitable material for insect tissue culture.

---

\*This work was supported in part by National Science Foundation Grant No. G17663.

La biologie du genre *Empicoris* Wolff. Hemiptera Heteroptera Reduviidae (Emesinae Stenolaemini), Dr Paul Dispons, D.C.I., Boulevard de Port-Royal, 37, Paris (13e) France.

Les biotopes des *Empicoris* sont variés (arbres, branchages, fagots d'essences diverses, buissons, feuilles sèches, mousses, lichens, pied de végétaux, roseaux, ajoncs, nids abandonnés, amoncellement de pierres, tuiles, planches....). L'attribution d'un habitat quasi-domestique à certains *Empicoris* n'est qu'une supposition basée sur des observations occasionnelles.

Les *Empicoris* sont des prédateurs et bien qu'en général ils ne soient pas inféodés à des proies particulières, l'existence de représentants du genre dans les nids de *Cocéognathes* pose l'hypothèse de la spécificité, au moins relative, de la proie et du biotope des espèces intéressées. Schumacher avait déjà pris, à Amani, dans le Tanganyika, *E. morstatti* Bergroth dans un tel biotope mais n'avait rapporté aucune autre observation. En 1959, M. Pujol devait recueillir une nouvelle espèce *E. disponsi* Villiers dans des nids d'*Archipsocus ghesquierei* Badonnel construits sur des branches de *Cola pallida*, à Sérédoug, en Guinée. Ces Psocoptères (*Psocomorpha Archipsocidae*) qui n'étaient auparavant connus que du Congo tissent sur les branchages des toiles souvent très étendues à l'abri desquelles ils vivent en colonies du type des sociétés inférieures d'insectes (au regard de la classification de Le Masne). En élevage, dans le biotope d'*Archipsocus ghesquierei* nous avons observé que la larve au premier stade de *E. disponsi* se déplaçait avec aisance sur les toiles dont les fils visqueux n'apportaient aucune gêne à ses mouvements, le dernier article des antennes, fusiforme, très acuminé à l'apex, tâtant la surface de la toile; une femelle dévorait également les psocques. Nous rapporterons, sans apporter d'interprétation, qu'en France, dans les Monts de la Madeleine (Massif central), nous avons observé la présence sur une toile d'araignée d'une nymphe de *E. culiciformis* (De Geer) auprès de l'arachnide qui ne lui marquait aucune hostilité.

L'adhérence, parfois constatée, de débris sur le corps des larves d'*Empicoris* est accidentelle. On n'a jamais observé chez ces *Emesinae* un comportement volontaire analogue à la prosoponie qui permet aux *Reduvius* de recouvrir leur corps de matériaux empruntés au milieu où ils vivent afin de se dérober aux vues.

Chez *E. culiciformis* la modalité de la pariaade procède de l'épithésie. L'oviposition se classe dans le mode par dispersion avec immobilisation permanente de l'oeuf au moyen d'un ovociment (cf. P. Dispons. Mém. Mus. nat. Hist. nat., Paris, 1955). En Bretagne, nous avons constaté une oviposition de *E. culiciformis* une quinzaine d'heures après une pariaade, une autre ponte fut relevée trois heures après un deuxième accouplement. La première pariaade avait débuté à 19h30 avec une durée de 90 minutes alors que celle de la suivante, le lendemain à 11h30, ne fut que de 5 minutes. Nous avons noté 30 secondes pour la ponte d'un oeuf. En Vendée, *E. culiciformis* a produit des ovipositions de 1 à 3 oeufs avec des incubations de 12 à 14 jours et *E. vagabundus* (Linné) des pontes variant de 1 à 6 oeufs avec des incubations de 12 à 13 jours.

THE ANTIGENIC PROPERTIES AND THE ANTIBODY RESPONSES OF THE  
HEMOLYMPH OF THE LARGE MILKWEED BUG, ONCOPELTUS FASCIATUS.  
Dorothy Feir and M. Antoinette Walz, Dept. of Biology, St. Louis University,  
St. Louis, Missouri.

Intramuscular injection of a rabbit with hemolymph of the large milkweed bug and Freund's complete adjuvant resulted in antibody production. Antibody production was demonstrated by the precipitin reaction when cell-free hemolymph was added to serial dilutions of rabbit antiserum in test tubes. The use of Ouchterlony plates showed that at least three antigen-antibody systems were present.

Smears of hemolymph were flooded with rabbit anti-hemolymph serum, rinsed, and stained with fluorescent labeled anti-rabbit globulin in an attempt to determine whether the hemocytes were also antigenic. Microscopic examination with ultra-violet light revealed non-specific fluorescence of both the control and the experimental slides. Consequently it could not be ascertained directly whether the hemocytes were antigenic.

Injection of milkweed bugs with rabbit serum by itself or with Freund's incomplete adjuvant did not result in antibody production as tested by the Ouchterlony plate technique. In order to determine how long the rabbit serum remained in the insect body, insects were bled at five hour intervals after injection with rabbit serum. This hemolymph was then tested with antirabbit serum by the Ouchterlony plate technique and rabbit serum was still present 85 hours after injection.

During the above experiments it was found that rabbit serum inhibited the normal melanization process of the hemolymph of the milkweed bug.

CUTICULAR PIGMENTS IN ORTHOPTERA. Semahat Geldiay,  
Dept. of Zoology, Ege University, Bornova, Izmir, Turkey.

The presence of melanin pigment in the cuticle of Orthoptera has been known for a long time. Okay (1954) showed that the protein-insectorubin pigment which is present in the epidermis of several species of insectes (Goodwin and Srisukh, 1950) may penetrate the endocuticle of Acrida as a diffuse reddish-violet free insectorubin.

The presence of pigments other than melanin in the cuticle was observed on several species of Orthoptera. The cross sections, which were made by a freezing microtome through the abdomen and the hind legs of the grasshoppers, were studied both chemically and histochemically.

In six species of Tettigoniidae which were studied, the cuticle contained only melanin pigment, whereas the endocuticle is free of pigment. In the nymphs and adults of Bradyporus, the well conspicuous orange areas on the inner side of the femur of the hind legs are formed by a yellowish melanin in exocuticle.

In twenty five species of Acrididae hitherto studied, the cuticle contained, according to the species, reddish-violet, blue, yellow or orange pigments besides varying quantities of melanin in exocuticle. The coloured areas which are seen with the naked eye on the inner side of the femur and tibia of the hind legs in many species of Acrididae, are formed by these pigments. The pigments are diffused and usually located in endocuticle. However the reddish-violet pigment in Glyptotermis passes into the exocuticle where it becomes more abundant than in the endocuticle toward the end of the nymphal instars and at the adult stage. The same coloured areas exist on the exuviae of this species.

Solubility and some other properties of these pigments are as follows: they are insoluble in most of the organic solvents such as carbon disulfide, petroleum ether, benzene and chloroform. They are soluble in acid-methanol and 96 % ethanol. This solubility explains why these pigments were not observed in fixed preparations until now.

The blue pigment, such as in the endocuticle of the male adult Celes and some other species shows a reversible colour change. It turns to pink in alkaline solution and blue-violet in acid.

None of these pigments showed redox properties which were tested by means of  $\text{Na}_2\text{S}_2\text{O}_4$  and  $\text{H}_2\text{O}_2$ .



# LA REGULATION THERMIQUE CHEZ LES VESPIDES

VUILLAUME M. LABORATOIRE DE PSYCHOPHYSIOLOGIE

15 PLACE CARNOT - NANCY - FRANCE

La régulation thermique est un phénomène important dans la vie d'un guépier.

La température intérieure d'un nid est maintenue constante, à moins d'un demi degré près tant que la population est suffisamment importante et à condition que l'involucre soit intact. Si l'involucre est détruit totalement ou partiellement, les guêpes le reconstruisent rapidement.

Si, lorsque l'involucre a été détruit, le nid est posé sur le sol, les guêpes le recouvrent de terre et de feuillets involucraires mixtes faits de boulettes de terre et de boulettes de "pâte à papier" étirées.

La lumière joue un rôle important dans la construction de l'involucre.

Le stimulus essentiel est la présence du couvain.

L'involucre est insuffisant à lui seul à assurer la régulation thermique. Si la température ambiante est inférieure aux 29° - 30° exigés par le couvain, les ouvrières consomment une quantité importante de sucres. On peut faire baisser à volonté la température d'un guépier en privant les ouvrières de sucres.

Si la température extérieure est excessive, les guêpes "ventilent" et évaporent de l'eau que des pourvoyeuses sont allées chercher au dehors et ont répandu sur les rayons.

CONTRIBUTION A L'ETUDE DE LA  
MORPHOGENESE DU SYSTEME NERVEUX CENTRAL  
DES INSECTES. Gaston Richard, Faculté des Sciences,  
Rennes, France.

Toute une équipe de jeunes chercheurs reprend actuellement à Rennes l'étude anatomique fine du système nerveux central des Insectes au cours de la morphogénèse. Les Insectes étudiés sont des Orthoptéroïdes, des Odonates, des Planipennes, des Isoptères, des Diptères, des Homoptères. Les variations de la forme et de la position générale des ganglions par rapport à la forme générale du corps sont mises en évidence par des reconstructions précises. On présente d'autre part ici quelques résultats concernant la structure, du corps pédonculé et du corps central des ganglions cérébroïdes en attachant une grande importance aux groupes cellulaires qui les environnent. Ces groupes cellulaires permettent de préciser mieux que la structure du corps pédonculé lui-même les homologues possibles entre les divers ordres d'Insectes.

Ces recherches de morphogénèse sont destinées à fournir des éléments précis qui appuient des recherches parallèles d'électrophysiologie effectuées dans un autre Laboratoire de la Faculté.

RASGOS FUNDAMENTALES DE LA ORGANIZACION Y DESARROLLO LARVAL DE LOS MUTELIDOS AMERICANOS. Argentino A. Bonetto, Direc. Recursos Naturales, Ministerio de Agricultura, Santa Fe y Consejo Nacional de Investigaciones Científicas y Técnicas de la República Argentina.

El estudio de la organización y desarrollo de los Mutelidos americanos resulta de mucho interés ya que, aparte de ampliar el campo del conocimiento biológico de estos moluscos, permite encarar sobre sólidas bases la consideración de importantes problemas sistemáticos, zoogeográficos y filogenéticos.

En el trabajo se describen las larvas de Anodontites trapesialis forbesianus(Lea), A. trapezeus(Spix), Mycetopoda soleniformis Orbigny, M. siliquosa(Spix), Monocondylaea paraguayana Orbigny, y Leila blainvilleana(Lea), prestando preferente atención a las diferencias observadas en los lóbulos anteriores, a los ganchos del tercio posterior, a la conformación del órgano adhesivo, y otros detalles que permiten establecer comparaciones con la larva descrita por Fryer para Mutela bourguignati(Ancey) Bourguignat, de Africa.

Las larvas de las especies Anodontites y Mycetopoda resultan bastante similares entre sí y corresponden al tipo de lasidium dado a conocer por Ihering. La registrada en Monocondylaea presenta considerables diferencias en el órgano adhesivo anterior, reducido a una cinta muy plegada que pronto se resuelve en una prolongación filiforme, reducción esta que se acentúa mucho en Leila blainvilleana(Lea), donde este complejo órgano, aunque de ancha base, define un verdadero filamento, muy largo, lo que unido a su mayor tamaño y a la conformación de los lóbulos anteriores, la llevan a aproximarse más a la mencionada larva de Mutela.

Por lo que hace al desarrollo de tales larvas, todas ellas parecen ser parásitas de peces, implantándose y evolucionando de un modo similar, pese a que el fenómeno sólo pudo estudiarse cabalmente en una sola especie: A. trapesialis forbesianus (Lea). Las investigaciones microscópicas de los preparados histológicos permiten llegar a la conclusión de que los procesos de desarrollo son coincidentes en gran parte con los descritos por Fryer en Mutela, pese a la existencia de notables diferencias relativas a la forma de implantación sobre el huésped y a la obtención de alimentos, diferencias estas atribuibles a una distinta adaptación al período de vida parasitaria.

Como conclusión se señala que existe una fundamental coincidencia en los caracteres más relevantes de la larva lasidium de los Mutelidos americanos con la larva haustorial señalada por Fryer para Mutela bourguignati de Africa, y que el desarrollo parasitario responde en ambas a un tipo unitario, pese a la existencia de evidentes diferencias que son señaladas, lo que sumado a la presencia de importantes caracteres conculógicos y anatómicos comunes entre los Mutelidos americanos y africanos, reafirma la necesidad de reunirlos en un mismo grupo claramente separado de las restantes Nayades cuya larva es un glochidium (Parodiz y Bonetto, 1962).

NIVEAU DE RUPTURE DE LA PATTE DES INSECTES. Bernard Possompès,  
Laboratoire de Zoologie, Faculté des Sciences, Paris, France.

L'articulation fémur-trochanter des Insectes constitue fréquemment un niveau où, selon diverses modalités, la patte peut se rompre et rejeter sa partie distale et, corrélativement, offrir une grande diversité de structure.

Le fémur de Periplaneta americana se meut avec une faible amplitude sur le trochanter par le jeu d'une jonction endocuticulaire souple. Une Blatte saisie par son fémur, exerçant une forte traction, se libère souvent en sectionnant sa patte au bord antérieur du fémur. Cette "autospasie" implique une rupture endocuticulaire accompagnée d'un arrachage du muscle élévateur du fémur et d'une branche du muscle fléchisseur du tibia. Aucune disposition anatomique particulière ne singularise l'articulation rompue.

Chez Locusta migratoria, toutes les articulations trochantéro-fémorales sont fixes. Sur les appendices saltateurs, métathoraciques, elles réalisent, sur le pourtour de la patte, une couronne cuticulaire dure, cassante, traversée en son milieu par une ligne de fracture; l'endocuticule y disparaît totalement. Une excitation du fémur provoque, en l'absence de toute traction, une "autotomie" réflexe à la limite des deux articles disjoints. Aucun muscle ne traverse le plan de rupture. Un diaphragme mésenchymateux assure l'hémostase. Ces particularités, absentes dans les pattes prothoraciques et mésothoraciques, non douées du pouvoir d'autotomie, constituent des adaptations à l'amputation réflexe.

Les Phasmoptères manifestent une capacité d'autotomie de leurs six pattes. L'articulation trochantéro-fémorale y est affectée de modifications similaires des dispositions décrites chez L. migratoria : structure cuticulaire cassante, absence de muscles chevauchant le niveau d'autotomie, présence d'un diaphragme hémostatique. De plus, un appareil constitué par deux languettes cuticulaires émanant respectivement du trochanter et du fémur et associées par des muscles y déclenche l'amputation réflexe. Ces Insectes réalisent ainsi, de toute évidence, l'adaptation articulaire autotomique la plus spécialisée.

SUR L'EVOLUTION BIOLOGIQUE DANS LE GROUPE DES CYNIPIDES GAL-  
LICOLES D'EUROPE OCCIDENTALE, (HYMENOPTERES, CYNIPOIDEA).  
Roger FOLLIOT et P.L. MAILLET, Laboratoire de Biologie Générale,  
Faculté des Sciences, Rennes, France.

Le groupe des Cynipides gallicoles est relativement très homogène du point de vue de la morphologie externe et interne. Mais l'étude détaillée des cycles de développement et des aptitudes cécidogènes des divers représentants du groupe, permet de déceler de nombreuses voies de diversification, (l'intérêt original de l'aptitude cécidogène est de permettre de saisir sur un plan morphologique précis, une propriété physiologique, spécifique de l'animal).

Les Cynipides les plus simples montrent une génération bisexuée annuelle, et quelques espèces sont réduites aux ♀. Nous avons mis en évidence la tendance à l'établissement de 2 générations par an, dans 3 espèces. Pour *Xestophanes brevitarsis* cette tendance est faible ; elle est forte dans une population géographiquement limitée de *Xestophanes potentillae* (La Rochelle, France) ; elle est complètement réalisée chez *Aulacidea pilosellae*, espèce réduite aux ♀. Ceci représente le premier fait de cet ordre à l'appui de l'hypothèse qui fait dériver l'hétérogonie d'un cycle à 2 générations sexuées annuelles.

Chez les Cynipides hétérogoniques, les cycles de développement montrent une complexité croissante dans les types suivants :

- *Biorhiza pallida* (pour une partie des individus)
- *Pediaspis aceri*
- *Andricus trilineatus*
- *Neuroterus quercus baccarum* (décrit par Doncaster)
- *Andricus quadrilineatus*

Ce dernier type atteint un degré de surévolution, caractérisé par la réalisation au même moment de l'année, des galles des formes agame et sexuée, se succédant cependant dans un cycle, et la tendance à l'élimination de la dernière forme.

D'autre part, des aptitudes cécidogènes différentes tendent à différencier et à isoler géographiquement des races, parmi les espèces *Xestophanes potentillae*, *Andricus sieboldi* etc..., ou permettent de saisir les clivages spécifiques dans un même genre, comme le genre *Cynips*.

L'hybridation expérimentale réalisée entre formes sexuées du genre *Adleria* avec des conséquences observables dans la forme agame, permet de comprendre un des mécanismes par lesquels l'Evolution du groupe s'est réalisée.

THE CHEMISTRY AND PHYSIOLOGY OF THE BRAIN HORMONE. Masatoshi Kobayashi, Sericultural Experiment Station, Suginami-ku, Tokyo, Japan.

In ordinary pupae of the silkworm, *Bombyx mori*, they emerged as moths in 11-14 days after pupation, in contrast to the pupae which were extirpated of their brains immediately after pupation, in which no imaginal differentiation was observed for more than 40 days after pupation, although the operated pupae survived for 300 days. Such a pupa was called 'Dauer-pupa'. When a fresh brain which was obtained either larva, pupa or moth was implanted into the head of 'Dauer-pupa', it became an imago in 16-25 days following implantation. Moreover, when each of 61 silkworms at the fifth stage was implanted into its abdomen 2 fresh brains obtained from the larvae of the same age, and the abdomen was isolated at 2 hrs. after pupation, 2 of the operated pupae became moths in 34-35 days after operation. This could not be repeated when 10 larval brains were implanted into each of 11 abdomens. From above-mentioned results it is concluded that in *Bombyx*, the hormone secreted from brain initiates an imaginal differentiation by affecting the prothoracic glands.

Glycogen content of normal pupa decreased with age, reaching the minimum at the day before imagination, while that of the 'Dauer-pupa' kept continuously a high level for more than 120 days following pupation, and oxygen uptake of the 'Dauer-pupa' was less in amount than that of the normal pupa. Electrophoretic pattern of blood protein in the 'Dauer-pupa' coincided with that of normal young pupa on account of the lack of brain hormone.

Following the histochemical views of neurosecretion of the brain, the brain hormone was obtained as crystal from some fractions of the extract of isolated brains, by means of counter-current distribution method and column chromatography. The chemical character of purified brain hormone was as follows: The melting point was 148°C.; no ultra-violet spectrum was found; infra-red spectrum, paper and gas chromatograms were identified with those of cholesterol; Liebermann-Burchard reaction was positive; gas chromatogram exhibited only one peak; the melting point of acetylated pure hormone was the same as acetylated cholesterol; and the melting point of the crystal and pure cholesterol mixture was determined to be the same as that of the crystal alone. From the foregoing chemical properties it was determined that the crystal isolated from the brain was identical with pure cholesterol.

When 0.02 µg. of each of pure cholesterol isolated from pupal brain and purified from commercial reagent respectively was injected into each 'Dauer-pupa', about 40 days old, injected animals emerged as moths in 18-27 days following injection at 25°C. From the foregoing results it is concluded that cholesterol is one of the most important principle of the brain hormone in an insect, *Bombyx mori*.

Crude brain hormone which was extracted by the method of solvent treatment using methanol-acetone-ether had two actions. The first was its tropic action on the prothoracic gland and the second was its direct, synergistic action with ecdysone on induction of metamorphosis.

Furthermore, the chemical property of the other active fraction without inclusion of cholesterol, separating from crude extract of the brain hormone was similar to that of Ichikawa & Ishizaki's extract. Therefore, it suggests that the brain hormone consists of sterol and other chemicals.

RATE OF INCORPORATION OF AMINO ACIDS INTO THE WEB PROTEINS OF THE SPIDER ARANEUS DIADEMATUS CL. David B. Peakall, Dept. of Pharmacology, State University of New York, Upstate Medical Center, Syracuse, New York, U.S.A.

The rate of appearance of labeled amino acids in the web proteins of *Araneus diadematus* Cl. is measured. The  $C^{14}$  alanine,  $C^{14}$  glucose or radioactive web protein were fed orally to the spider. The webs are digested, the number of counts of radioactive disintegrations per minute measured and the total nitrogen content of the web determined. Thus it is possible to calculate the amount of incorporation of the labeled material that has taken place. The same procedure was used for thread that had been pulled from the spider. This method has the advantage that the time scale can be altered at will. Using either method the experiment can be carried out over a long period of time as the spider is not harmed. The effects of drugs such as physostigmine (1 mg/kg given orally) which is known to increase the production of thread and protein blocking drugs such as puromycin (100 mg/kg) were examined.

The rate of production of web proteins was also studied at the glandular level. Spiders with active glands (activated by pulling of thread), resting and after being given drugs were examined. By slaughtering after various time intervals and staining for nucleic acids and proteins it was possible to follow the processes of production and secretion of web proteins. The rate of incorporation of amino acids into the web proteins and the passage of this protein to the spinnerets was studied more specifically by the use of autoradiography.

- A. Christiansen, R. Baum, and P. N. Witt: Changes in spider webs brought about by mescaline, psilocybin and an increase in body weight. *J. Pharmacol.* 136: 31, 1962.
- P. N. Witt: Effects of atropine on spider's web building behavior and thread production. *Fed. Proc.* 21: 180, 1962.

OBSERVATIONS ON THE BIOLOGY OF HYPOASPIS ACULEIFER CANESTRINI, 1885 (ACARINA; LAELAPTIDAE), A MITE APPARENTLY NEW TO NORTH AMERICA. D.Keith McE. Kevan and G.D. Sharma, Dept. of Entomology and Plant Pathology, McGill University, Macdonald College P.O., Que., Canada.

Hypoaspis aculeifer is a predatory mite known in Europe from a variety of habitats, including soil. The species has now been found in S.W. Quebec in soil and litter under maple trees. Rearing was carried out in the laboratory under different temperatures using a culture of Tyrophagus putrescentiae (Acarina; Acaridae) as food. Various Collembola were also offered but successful rearing was not achieved when these were provided. The external changes in body setae and sclerites were observed during the life history. Males are smaller than females which lay eggs singly. At 24°C. eggs hatch in 24 hours and the adult stage is reached in approximately 12 days. At 17°C. the mean duration of these periods are 50 hours and 17 days, respectively. At 11°C. eggs take 12 days to hatch and the developmental period is prolonged. No oviposition occurred at 8°C. or less; transferred eggs incubated at 8, 4 and 0°C. failed to hatch, but adults survived for more than a month at the lowest of these temperatures.



THE CAVE OPILIONIDS OF THE UNITED STATES. Clarence J. Goodnight and Marie L. Goodnight, Department of Biological Sciences, Purdue University, W. Lafayette, Indiana.

Many species of opilionids live in dark, humid situations; thus they are often found in caves. While cavernicolous forms are found among most groups, it appears that some types must be much more genetically plastic. Among these latter, far more troglobitic forms are found.

Within the United States and Mexico, members of all three suborders of Opiliones are found. These are the Cyphophthalmi, the Laniatores, and the Palpatores. In this region, the cavernicolous forms are found mostly among the members of the suborder Laniatores. Three families are represented within this suborder in the United States and Mexico, the Cosmetidae, Phalangodidae, and Triaenonychidae. The family Phalangodidae has the greater number of troglobites, with but one true cave form known from the Triaenonychidae.

The adaptations to cave life consist of such traits as reduction or even complete loss of the eyes, increased length of legs, lighter color, and less sclerotization. A few species show an increase in size in contrast to their related epigeal species. Little is known of the physiological adjustments of these cave forms, but their structure and habits appear to indicate greater susceptibility to drying than related epigeal species.

Within the United States, there appear to be four different cave regions in which distinctive troglobites have developed. The greater number of moist caves are found in the southeastern states (Kentucky, Tennessee, West Virginia, southern Indiana, etc.). In these caves, a number of true cave types have developed, most of which are members of the family Phalangodidae.

A second region with cave opilionids is found among the caves of central Texas. Here at least two distinct cavernicolous phalangodids have evolved, one related to troglobites known formerly only from the caves of northern Mexico.

The third region is that of the caves of California. Here other phalangodids have developed. The fourth area consists of regions of Montana and Idaho in which some distinct types including the only known American cave triaenonychid are found.

A study of these cavernicolous forms has proved useful in the development of zoogeographical concepts of arachnid distribution.

INTEGUMENT OF TUNICATA. Jean E.A. Godeaux. Dept. of Zoology, State University Elisabethville, Congo.

Integument is often characteristic of a zoological phylum or class. It is especially the case for Tunicates, the tunic of which behaves as a pseudo-mesenchym embedding various cells mostly of mesodermal origin, widespread in a more or less dense secretion product or ground substance covered with a thin layer, the cuticle. For a century, since the investigations performed by SCHMIDT, and LOWIG and KOLLIKER, the tunic has been classically regarded as a kind of animal cellulose.

In larvae, the tunic appears early from intra-epidermic yolk inclusions missing in thin sheathed species (e.g. *Doliolum*). These inclusions are glucidic and proteinic homogeneous large granules, lying beside the nucleus and Golgi bodies: epidermis is slowly exhausted and flattens. At the beginning, cells are completely missing but invade secondarily the ground substance.

The ground substance is heavily hydrated and its dry weight represents less than 10% of the fresh weight in all the species investigated. Ground substance is highly variable, mostly amorphous in lower Ascidiacea and Thaliacea and fibrous in Stolidobranchiata. It is difficult to get ground substance devoid of nitrogenous compounds: e.g. in *Ciona*, N<sub>2</sub> expressed in proteins, would correspond to c.50% of dry weight of the tunic. Ten different amino-acids were found by chromatography of acid hydrolysates, but part of N<sub>2</sub> is probably bound as hexoseamine. The presence of polysaccharides, both neutral and acidic, has been histochemically proved with various reagents. Fibrous fraction is not wellknown yet: at least in lower Ascidiacea, fibers seem to be only local condensations of the surrounding matter, histological tests being more intense at their level.

The tunic has a composition more complex than expected from the early analysis: it is built of polysaccharic and proteinic fractions, in variable proportions according to the species, more or less firmly bound together: cellulose represents only a small part if any. Investigations are in progress.

GENETIC CONTROL OF PIGMENTATION IN BOTRYLLUS SCHLOSSERI.  
Armando Sabbadin, Institute of Zoology, University of Padua, Italy.

Four main pigments are involved in the pigmentation of the zooids of the colonial Ascidian Botryllus schlosseri : a blue and a reddish pigment, primarily concerned with the ground color of the animals; an orange pigment, preferentially arranged around the oral and atrial siphons, and a purine pigment, which looks yellow by transmitted, and silvery by reflected light. The latter on the dorsal surface of the zooids is either dispersed or arranged into definite color markings, the intersiphonal bands and the peristomatic ring.

All these pigments affect similar vacuolar blood cells, wherein they are dissolved (the orange pigment), or present in granular form (the blue, reddish and purine pigments).

Unlike the purine pigment, which is constantly present, the three other pigments may be lacking. Their different combinations, together with the color markings due to the purine pigment, make up many different color patterns, that once were considered as taxonomic characters.

Genetical analysis, still in progress, has so far proved that a) the orange pigment shows a simple Mendelian inheritance, an allele for the presence of the pigment being completely dominant over the allele for the absence. - The blue pigment seems also under genetic control. - As yet nothing is known about the heredity of the reddish pigment; b) a series of three alleles at a single locus,  $B_1$ - $B_2$ - $b$ , account for the two types of intersiphonal band and for its absence. There is a complete dominance of  $B_2$  over  $B_1$  and of both  $B_2$  and  $B_1$  over  $b$ . - As to the peristomatic ring, it is also controlled by allelic genes, the one for the presence of the trait being dominant over that for the absence; c) the three characters, orange pigment, intersiphonal bands, peristomatic ring, are inherited independently.

Orange and blue pigments, if lacking, can be given to a colony through a short time parabiosis with another colony provided with them. Only single pigment cells pass from one to the other colony during the parabiosis, but the blood of the donor maintains in the host the ability to build up the pigment cells and, as to these pigments, the host slowly becomes indistinguishable from the donor. Thus the host changes to a color chimera, that in its origin does not differ from the red cells chimeras in Vertebrates.

ENDOCRINE SECRETIONS AND METALS IN THE GENERATION OF NEW TISSUE  
IN THE GENUS EUDISTOMA.

Estees Potter Levine, Department of Biological Sciences,  
San Jose State College, San Jose, California.

Tadpole larvae obtained from Eudistoma ritteri and Eudistoma molle were retained in the laboratory in finger bowls of sea water at temperatures ranging 7 - 10° C. Many were surgically removed from the parental thorax. Swimming was not necessary to initiate metamorphosis. These larvae were observed intact and histologically for developmental changes.

Colonies founded by the settling and adherence of tadpoles to the substrate were followed through the first, and sometimes the second, budding. In Eudistoma ritteri the sexual and asexual reproductive cycles are separate and seasonal. The oozoid must pass through at least one strobilation, budding, and regeneration before becoming sexually mature.

Zooids from sample colonies collected in the field were also examined for manifestations of sexual and asexual reproductive activity. In addition, about 1500 - 2000 of these were dried, ashed, and spectrographically analyzed for Ti, V, and Cr which is concentrated by these ascidians; monthly analyses were done.

"Synapoidin" (chorionic gonadotropins and follicle stimulating hormone--gonadal synergist) extracted from mammals was introduced into the ambient sea water of finger bowls in which individuals were undergoing metamorphosis. A drop or two induced these slightly protandric tunicates to precociously develop testes from the hermaphroditic gonad. Tunicate neural gland macerate induced follicles on the ovaries of immature mice.

Strobilation and budding is under organized control. Internal reorganization (physiological isolation) has taken place before the segments have separated themselves from the esophageal region of the abdomen. Regeneration requires the presence of endocrine secretions and related metals.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

1B. INVERTEBRATE ZOOLOGY

FURTHER STUDIES ON THE CYTOLOGY AND LIFE HISTORY OF THE ZOOXANTHELLA, SYMBIODINIUM MICROADRIATICUM (FREUDENTHAL).\* Hugo D. Freudenthal and John J. Lee, American Museum of Natural History, New York, New York, C. W. Post College, Greenvale, New York, and New York University, New York, New York.

In vivo and in vitro cytochemical studies have extended our knowledge of the morphological features of the zooxanthella, Symbiodinium microadriaticum (Freudenthal). In periodic-acid Schiff (PAS) and Gamori's trichrome preparations, the chloroplasts are discoidal and enveloped by a PAS-positive sheath. The assimilation body is also PAS-positive. During cystic division, one daughter cell keeps the old assimilation body and the other daughter receives a fibril around which a new body is built by accretion as the fibril expands in length and folds over on itself. The nucleus in hematoxylin preparations appears beaded, but in phase and in Feulgen preparations the chromosomes are clearly filiform. Mitotic figures have been studied.

Additional evidence has been obtained to substantiate the formation of gametes or some other type of small reproductive body; studies of Feulgen preparations of cells raised in vitro have shown continuous stages leading from a cell with a large assimilation body and a single nucleus to a multinucleate cell with roughly twelve nuclei. These nuclei are distinguished from vegetative nuclei by peripheral chromatin and a central Feulgen-negative endosome. During nuclear division, Feulgen-positive granules are cast into the cytoplasm and persist after division. All nuclei in tissue sections from a Pacific anemone were in late prophase or in division, while nuclei in cystic cells from a zenic culture were generally found in interphase. The assimilation bodies in the anemone sections were much larger than those in cells from culture.

---

\* This work is being supported by N.S.F. Research Grant G 16329.

LIFE CYCLE AND MORPHOLOGY OF A NEW POLYMORPHIC ALLOGROMIID.  
John J. Lee & Stanley Pierce, Living Foraminifera Laboratory,  
American Museum of Natural History, New York, and Department  
of Biology, New York University, New York.

The morphology of a polymorphic allogromiid (our strain NF), raised in a monoxenic bacterized culture, has been studied. It displays isomorphism similar to that reported for Allogromia laticollaris (Arnold, 1954). Organisms vary from ovoid to elongate bioral Shepherdella-like forms and to irregular polyoral organisms. One hundred randomly selected organisms measured  $118 \mu + 50.54$  (range 56-385  $\mu$ ) in length and  $99 \mu + 39.34$  (range 35-385  $\mu$ ) in width. Most organisms were multinucleate and diploid. The number of nuclei in thick sections of 250 fixed and stained organisms averaged  $8.9 \pm 6.3$  (range 1-40). Only 13 were mononucleate.

The organisms is colorless, unlike A. laticollaris and A. ovoidea. Like A. laticollaris, it has a well-developed collar and peduncular sheath. The test wall is yellowish and stains, as does the collar, for polysaccharide in PAS preparations. The outer collar is raised from the surface of the organism and varies in width from 2 to 3 times the diameter of the peduncular sheath and outer collar.

In fresh monoxenic cultures the majority of organisms were "Shepherdella-like" and reproduced by binary fission. As cultures aged "Allogromia-like" forms, giant forms (300-400 $\mu$ ), and polyoral forms became more frequent. Three types of budding have been observed. Schizogony is rare. No evidence for sexual reproduction has thus far been obtained.

## ULTRASTRUCTURE DU TISSU LARVAIRE DES DEMOSPONGES

Claude Lévi, Laboratoire de Biologie générale,  
Faculté des Sciences, Strasbourg, France.

L'étude, au microscope électronique, de plusieurs larves de Démosponges, amphiblastula d'Oscarella et parenchymella de Mycale, Ophlitaspongia, Halichondria et Adocia, avant et après la métamorphose, apporte diverses précisions nouvelles sur la structure larvaire des Spongiaires.

Chez toutes les espèces étudiées, dont les caractères cytologiques sont très divers, les cellules flagellées périphériques ont deux centrioles, perpendiculaires, apicaux, juxtaposés comme chez Oscarella ou Mycale, ou éloignés, comme chez Halichondria. On n'observe pas de rhizoplastes, mais des racines ciliaires, simples ou doubles et obliques, un appareil de Golgi de type parabasal, surtout chez Oscarella. Halichondria a des cellules flagellées à noyau encapuchonné dans une enveloppe fibrillaire, qui s'étend en cône apical et se trouve en contiguité avec le centriole flagellaire.

A la métamorphose, les flagelles sont entièrement résorbés dans le cytoplasme.

Sous la couche de cellules flagellées, le mésenchyme des parenchymella est toujours riche en collagène, dont le diamètre des fibrilles et leur périodicité varient avec l'espèce. Toutes les cellules du mésenchyme ont une structure microvésiculaire, sans formations ergastoplasmiques élaborées, avec nombreux ribosomes groupés et généralement dictyosomes denses, juxtanucléaires. Elles paraissent toutes pouvoir fonctionner comme fibroblastes, à l'exception de cellules à grosses vacuoles, dont l'origine est encore inconnue.

Les larves de Mycale et d'Adocia ont des silicoblastes, sans caractères cytologiques particuliers. Dès le stade larvaire, les spicules s'élaborent sous forme de baguettes protéiniques, qui s'étendent entre deux ou plusieurs très grands vacuoles terminales, où se produit la croissance spiculaire.

Au début de la métamorphose, on constate simultanément, la résorption flagellaire et les déplacements des pinacocytes primaires, qui proviennent du mésenchyme interne ou postérieur. La jeune éponge fixée, sans types cellulaires supplémentaires, contient les restes de nombreuses cellules vacuolisées, dans sa fraction supérieure.



TWO PHYLOGENIC LINES IN THE COELENTERATES FROM THE VIEWPOINT OF THEIR SYMMETRY. Tohru Uchida, Zoological Institute, Faculty of Science, Hokkaido University, Sapporo, Japan.

The symmetry must be discussed not only on the adult morphology, but also on embryological process. In this respect, the Hydrozoa and Scyphozoa are radially symmetrical, but the Anthozoa are bilaterally symmetrical. The primitive planuloid form possibly differentiated into two forms, one with radial symmetry and the other with bilateral symmetry, both pelagic in the earlier stage and borrowing in sand in the later stage. The primitive form of Hydrozoa seems to be a Hybocodon-like hydroid and the primitive form of Anthozoa seems to be a Ceri-anthus-like polyp.

THE CONTRACTION BURST PACEMAKER SYSTEM IN HYDRAS. C. B. McCullough, Dept. of Biology, Yale University, New Haven, Connecticut, U.S.A.

Under constant conditions, individual hydras (*Hydra littoralis*; *H. pirardi*) show bursts of longitudinal muscle contractions. These occur every 5-10 min and reduce the polyp to a tight ball. Each burst lasts 30-60 sec. Electrophysiological recording shows large (30 mv), slow (250-500 msec), compound potentials occurring prior to each coordinated contraction. They are conducted non-decrementally at about 20 cm per sec. Each burst contains a characteristic number of pulses (5-7 in *H. pirardi*; 12-15 in *H. littoralis*). The firing is patterned: intervals between potentials are shortest in mid-burst and remain proportional despite variation in burst duration. Similar patterned bursts, lasting 5-10 sec and containing fewer impulses, occur with individual tentacle contractions. Single electric shocks elicit single contractions, not a burst.

A light flash (maximum effective wave length shorter than 500 mμ) as brief as 0.2 sec given to a dark-adapted animal during the interval between any two burst pulses, may halt the burst. Partial blocking is produced by stimuli of reduced intensity. When 10-15 consecutive bursts are so blocked, the burst initiation rate rises. Blocking thresholds also rise and eventually a vigorous burst occurs in spite of the inhibitory stimuli. Burst frequency then returns to normal levels.

Blocking experiments with localized illumination show that the contraction burst pacemaker is within the sub-hypostome tentacle base region in normal animals. Extirpation of this region at first blocks contraction bursts entirely; subsequently they reoccur but at a greatly reduced frequency, a ten-fold drop to about 2 bursts per hour. Such "decapitation" also eliminates the contraction response to sudden shaking (see Rushforth et al, 1963).

Termination of bursting is the initial phase of a dark-adapted animal's characteristic behavioral response to light. When a light is turned on, spontaneous contractions cease and the polyp extends to twice its resting "dark" length. After 3-5 min the extension ends, either in locomotion with tentacle attachment and a somersault (typical in animals starved for 2-3 days) or in a contraction burst. Bursts then reoccur frequently, so that the burst frequency doubles. These responses to illumination will be illustrated with a short time-lapse motion picture.

Contraction bursts of well-fed *H. littoralis*, kept under conditions approximating their natural environment, show a frequency of 8-12 per hour during daylight. At night the rate declines to 4-6 per hour. When starved, overall contraction burst frequency gradually declines.

Contraction bursts are one of the most obvious features of hydra behavior. They are significant biologically in that they give frequent intermittent sampling of the space around the polyp. The burst is also an integral part of locomotion and of light orientation. The specific conducting pathway for these potentials has not been established. The nerve-net may not be involved, as there is a second conducting system, the "rhythmic potential" system (Passano and McCullough, 1962), in these animals. The latter is believed to control contraction burst initiation. While the characteristics of the potentials suggest intermuscular rather than neuronal transmission, it is believed that the burst pacemaker is neuronal.

## SUR LA PHYLOGENESE DES SIPHONOPHORES.

Eugène LELOUP, Inst. r. Sc. nat., 31, rue Vautier,  
Bruxelles 4, Belgique.

Chez tous les Siphonophores, le développement de l'oeuf fécondé est identique jusqu'au stade Planula.

Chez les Physophorides, une cavité apparaît au pôle aboral; elle forme le flotteur. Un étranglement annulaire le sépare de la région orale qui devient le gastérozoïde primaire. Dans une telle larve, Siphonula, la région moyenne s'allonge en une tige verticale (hydrosome) qui donne naissance à deux zones superposées de bourgeonnement: la supérieure = nectosome et l'inférieure = siphosome. La cavité gastrovasculaire du siphosome se poursuit dans celle du nectosome suivant un axe rectiligne.

Chez la Calyconula des Calycophorides, le flotteur ne se forme pas. Une cloche larvaire, organe mésoglérique massif, naît avant l'apparition des zones prolifères. Sur la tige, à la base de son somatocyste, bourgeonne le pédoncule de la première cloche définitive.

Chez les Prayomorphes, à cloches identiques et plus ou moins nombreuses, il s'allonge. Il butte contre la cloche larvaire; la masse inerte de celle-ci le fait dévier latéralement. La cavité gastrovasculaire de l'hydrosome se brise; celle du siphosome continue, en sens inverse, dans celle du pseudonectosome.

Chez les Diphyomorphes, la cloche larvaire devient rapidement très active. La vitesse de la croissance et le dynamisme des premières cloches (larvaire et définitives) entrave l'accroissement de l'hydrosome au-dessus des cornues; il ne se forme pas de pseudonectosome. La zone de bourgeonnement des cloches définitives, très actives, hétéromorphes et en nombre réduit, se cantonne au sommet du siphosome, à la base du somatocyste larvaire d'abord et de la cloche supérieure ensuite. Elle représente, en réduction, le nectosome des Physophorides.

LE COLLOBLASTE DES CTENOPHORES : ULTRASTRUCTURE, SIGNIFICATION  
 Raymond Hovasse et Pierre de Puytorac. Laboratoire de Zoologie,  
Faculté des Sciences, Clermont-Ferrand, France.

Le colloblaste, élément caractéristique de l'épithélium des tentacules, dans le phylum des Ctenophora, étudié au microscope optique par Chun (1880), R.Hertwig (1880), Samassa (1892), C.Schneider (1902), Abbott (1907), T.Komai (1922), R.Weill (1935), est imparfaitement connu. Nous cherchons à combler cette lacune par la microscopie électronique, chez Pleurobrachia pileus Fleming.

On sait que le colloblaste mûr comporte un hémisphère réputé collant, la collosphère, fixé à l'axe des tentacules par deux filaments, dénommés, l'un axial, l'autre spiral.

Nous démontrons que ce colloblaste est bien une cellule; que les "grains éosinophiles" de la périphérie de la collosphère sont liés chacun, par un tractus fibreux, au "corps sphéroïdal", qui centre celle-ci. Ce corps est encastré à l'extrémité distale du noyau cellulaire, lequel, à partir de là, s'effile, entouré d'une mince couche cytoplasmique, vers l'axe du tentacule : c'est lui qui constitue le filament axial.

Le filament spiral est un tube cylindrique plein, de 0,5  $\mu$  de diamètre, issu du corps sphéroïdal, et qui rejoint l'axe du tentacule en décrivant des spires autour du filament axial. Intracellulaire au niveau du corps sphéroïdal, mais dans un puits cytoplasmique, il se dégage ensuite de la cellule, en apparence toutefois : il reste, en effet, entouré d'une membrane, en continuité avec celle de la cellule : pendant tout son parcours, il reste donc intracellulaire.

D'autre part, la membrane qui le relie à la cellule se replie en un système de 6 à 10 crêtes longitudinales, parallèles entre elles et disposées du côté tourné vers le filament axial. Ces crêtes, hautes d'un demi micron, indiquent une forte dissymétrie structurale qui peut expliquer la disposition spirale du filament et une élasticité possible.

Les colloblastes se forment par groupes de 6 à 8, recouverts chacun, ainsi que l'a vu Schneider, par une grosse cellule couverte, très riche en chondriome et ergastoplasme, et qui disparaît à maturité. Ils en sont séparés par les "grains brillants" des auteurs, sphères labiles, à contenu clair et dont l'origine nous échappe.

Le filament spiral paraît résulter de la modification d'un flagelle interne, ainsi que l'indiquent les deux faits suivants : Dans un cas anormal, nous avons trouvé, au milieu de colloblastes achevés, une cellule non transformée, avec un long flagelle typique, en rapport avec un cinétosome aussi typique, accolé au noyau. D'autre part, dans de jeunes filaments spiraux, nous avons trouvé des fibrilles périphériques, à demi estompées, mais vraisemblablement au nombre de 9. Il semble ainsi que le filament spiral soit un flagelle transformé, et que, par suite, le corps sphéroïdal soit un centrosome.

DIGESTION IN TRICLAD TURBELLARIA. J. B. Jennings, Department of Zoology, The University, Leeds 2, England.

Digestion in the triclad Turbellaria has previously been believed to be entirely intracellular, following phagocytosis of food particles by columnar cells of the gastrodermis. Histochemical techniques for the demonstration of proteolytic enzymes, however, show that in both aquatic and terrestrial triclads there is in fact a certain amount of extracellular proteolysis in the gut lumen before the food is phagocytosed. The protease responsible for this lumen digestion has been identified as an endopeptidase of the cathepsin C type secreted by "sphere cells" of the gastrodermis. These "sphere cells" have previously been regarded as protein reserves.

Intracellular digestion, traced by histochemical methods, is effected by an endopeptidase similar to that produced by the "sphere cells"; various exopeptidases of which one, leucine aminopeptidase has been identified; a lipase; and unidentified carbohydrases. All these enzymes are secreted from the cytoplasm of the columnar cell into the food vacuoles, the endopeptidase being the first to appear and then gradually being replaced by the others. Acid phosphatase can be demonstrated in both cytoplasm and food vacuoles in the earlier, endopeptidase, stages of intracellular digestion; this is replaced by intense alkaline phosphatase activity during the later stages.

SOME HYDROLYTIC ENZYMES IN TWO DIGENETIC TREMATODES.

D. W. Halton, Department of Zoology, The University, Leeds 2, England.

Biochemical and histochemical techniques have been used to identify some of the hydrolytic enzymes in the digenetic trematodes Haplometra cylindracea Z., and Fasciola hepatica L.

Biochemical techniques demonstrate the presence of a protease, a dipeptidase, a lipase and acid and alkaline phosphatases in both these animals.

Histochemical methods show the presence of non-specific esterase in the suckers and associated gland-cells of H.cylindracea, indicating the possibility of extracorporeal digestion. Merocrine secretion of esterase has been observed in the intestine of both flukes and there is evidence that the resulting extracellular digestion of foodstuffs is continued and completed in the gastrodermis. Merocrine secretion in F.hepatica is accompanied by strong acid phosphatase activity.

The vitellaria in both species contain leucine aminopeptidase, alkaline phosphatase and lipase and it would appear that these structures are centres of intense metabolic activity.

The excretory duct walls in F.hepatica possess much alkaline phosphatase and it is suggested that here this enzyme is linked with selective carbohydrate absorption from the animal's excretory system.

CONSIDERATIONS SUR LA REPRODUCTION DES SANGSUES DU GENRE TROCHETA.  
Roger Husson, Laboratoire de Biologie Animale et Générale, Faculté  
des Sciences, Dijon, France.

Le genre Trocheta désigne des sangsues appartenant au sous-ordre des Pharyngobdellés. Il comporte cinq espèces dont deux seulement ont été observées à plusieurs reprises et par différents auteurs ce sont :

Trocheta subviridis Dutrochet récoltée en France (d'où elle fut décrite), Angleterre, Belgique, Luxembourg, Italie et peut-être Autriche.

Trocheta bykowskii Gedroyc signalée en Pologne (Carpathes d'où elle fut décrite) et dans la plaine roumaine ainsi qu'en Autriche, Suisse, France, Belgique, Pays-Bas et Angleterre.

Dans ces trois dernières années nous avons pu récolter ces deux espèces en Bourgogne. En France, à l'opposé de l'Angleterre, T. subviridis n'est pas très fréquente n'ayant été capturée jusqu' alors que dans 8 stations, nous avons trouvé 3 autres stations (une en 1960, une en 1961, une en 1962). Quant à T. bykowskii elle est vraiment rare puisqu'elle n'était connue qu'aux environs de Lyon, nous l'avons rencontrée en 1961 et 1962 près de Dijon.

Un des intérêts majeurs de ces récoltes réside dans les précisions que nous pouvons apporter sur l'époque de reproduction de ces Sangsues qui semblait mal connue.

On sait que chez les Hirudinées la maturité sexuelle se révèle par l'apparition d'un clitellum et que la fécondation y est hypodermique par implantation de spermatophores. On ne peut alors juger avec précision de la période de reproduction de ces Sangsues qu'en rencontrant des individus à clitellum bien différencié ou portant des spermatophores ou des cicatrices d'implantation de spermatophores.

Ayant pu récolter d'une part à la fin de février 1961 et en mars 1962 des T. subviridis avec clitellum bien différencié et avec traces d'implantation de spermatophores et d'autre part à la même époque des T. bykowskii avec clitellum et un exemplaire encore porteur d'un spermatophore implanté dans ses téguments nous pouvons affirmer que sous nos latitudes la reproduction des Trocheta se fait à la fin de l'hiver.

DONNEES NOUVELLES SUR LA REPRODUCTION DE COCCIDIES EXTRA-CELLULAIRES PARASITES D'ANNELIDES POLYCHETES. Emile Vivier, Institut de Zoologie, Faculté des Sciences, Lille, France.

L'annélide Polychète Nereis diversicolor O. F. M. héberge dans son coelome une Coccidie, Eucoccidium durchoni (Vivier 1961) dont le développement est toujours extracellulaire. L'étude de la reproduction de ce parasite est intéressante à plusieurs égards: elle révèle des faits nouveaux et apporte des précisions sur certains points mal éclaircis ou controversés. Les principaux résultats de cette étude ont trait aux points suivants: corrélation avec le cycle de l'hôte, évolution des gamontes, cytologie des divisions nucléaires.

Dans la nature la Coccidie n'est jamais présente chez les vers immatures, mais seulement chez des vers en cours de maturité sexuelle, quel que soit leur sexe. L'apparition du parasite, sa croissance, sa gamogonie et sa sporogonie vont de pair avec la maturité de l'hôte; cette évolution peut être déclenchée par les diverses interventions expérimentales qui commandent la maturité sexuelle chez les Néréidiens (ablation cervicale par exemple).

Si une reproduction végétative n'a pas été rencontrée et paraît absente du cycle, la reproduction sexuée se déroule en présentant un phénomène nouveau: l'exuviation des gamontes. A un moment précis de leur évolution les gamontes se débarrassent d'une enveloppe externe ou exuvie. Pour le gamonte mâle, le phénomène a lieu au moment de la poussée des flagelles des gamètes mâles en formation; pour le gamonte femelle, il précède de peu la fécondation et permet ainsi la libération de l'individu qui est le gamète femelle véritable. Il semble qu'au cours de cette opération ait lieu, pour le gamonte femelle, la libération d'une substance qui attire les gamètes mâles libres dans le milieu.

La multiplication des noyaux au cours de la gamétogénèse mâle comme au cours de la sporogonie, se fait suivant des mitoses coccidiennes classiques; le seul stade de métaphase typique qui soit détecté apparaît après la fécondation, au cours de la 1ère division du noyau de l'oocyste, division qui est considérée comme réductionnelle. Contrairement à ce qui a été signalé pour d'autres espèces, le noyau du gamète femelle ne semble pas subir de modifications avant la pénétration du gamète mâle. Les premiers stades de la multiplication nucléaire dans le gamonte mâle peuvent être distingués des premiers stades de la multiplication nucléaire dans l'oocyste par le fait que, dans le premier cas seulement, subsiste longtemps la trace du gros noyau du trophozoïte, de même que le caryosome ne s'y réduit que très progressivement.



INDUCTION OF MALES IN A USUALLY PARTHENOGENETIC ROTIFER.  
Helene N. Guttman and Aimlee D. Laderman. Haskins Labora-  
tories, New York City, U.S.A. and Dept. of Biology, Univer-  
sity College, New York University, New York 53, N.Y., U.S.A.

Our laboratory cultures of Brachionus rubens had reproduced parthenogenetically regardless of whether they were maintained in the dark or if they were offered a variety of day lengths, sharp changes in incubation temperatures, or changes in food supply.

Males are produced in these cultures after they are exposed to short light periods (less than one hour) after prior prolonged incubation in darkness.

There is a refractory period following the appearance of males during which male production could not be induced.

Appearance of males as a biological rhythm, interrupted by usual laboratory cultivation, is discussed.

THE FEMALE UROGENITAL ORGANS OF PRIAPULUS CAUDATUS LAMARCK. Arne Nørrevang, Inst. of Comp. Anatomy, Univ. of Copenhagen, Universitetsparken 3, Copenhagen, Denmark.

The ovary proper of *Priapulus* was correctly described by Ehlers (1862) and Apel (1885), and the excretory organs by Moltchanov (1908) and Lilling (1940), however, the anatomical interrelations of these systems were never correctly stated. The ovary consists of flat ovarian sacs reaching between the oviduct and a pseudomesenterium. They are set at an angle to the oviduct, into which they open through a labyrinthic system of septa with single-layered epithelium. The ovarian sacs likewise have a single-layered epithelium, and a basement membrane (a glycochelix) separating it from the coelom. The wall cells of the ovarian sacs are provided with a strong flagellum, the multiple rootlets of which reach the basement membrane, and a varying number of microvilli, through which a lively micropinocytotic activity seems to take place. The wall cells appear to be oogonia. Any one of them may loose its flagellum and microvilli, and as oocyte growth commences it bulges out into the coelom. Finally, the oocyte is found hanging on the outside of the ovarian sac, attached to the ovarian sac only by one or two of the wall cells, which form a sort of shallow cup. In the initial stages of ovulation, the mature oocytes hydrolyse their way into the lumen of the ovarian sacs through the cup cells, which disintegrate. Many oocytes were seen sitting as plugs in the holes in the walls of the ovarian sacs, but the rest of the ovulation mechanism remains unknown.

The oviduct sends a spout into the nephridial sacs or the rostral parts of the excretory duct. The rather spaceous nephridial sac may be subdivided into several sacs. The solenocyte trees open into these sacs and hang freely into the coelom delimited from the latter only by a glycochelix. The solenocyte trees ramify into several generations of branches, the solenocytes proper being situated terminally. Each solenocyte is provided with a flagellum and a large number of microvilli, all of which extend far down the branch generations. Before reaching the nephridial sac the material excreted passes between opposed brush borders in a septate so-called filtering pad. The wall cells of the nephridial sacs are also provided with a brush border. In some individuals the excretory duct was seen to function in its rostral part as a bladder together with the nephridial sacs. The caudal part, which runs through the muscle layers of the body wall, is always narrow with a high epithelium arranged on septa and provided with a sphincter.

Between the branches of the solenocyte trees, amoebocytes which are strongly PAS-positive, were observed to disintegrate, their contents of PAS-positive substances spreading diffusely into solenocytes and cells of the wall of the branches. This process was also observed in ultrathin sections. The walls of the nephridial sacs and the excretory duct show a very strong alkaline phosphatase reaction. As there are only fenestrated cellular membranes between solenocytes and wall cells in the solenocyte tree, coelomic fluid may diffuse rather unimpeded through the glycochelix into the lumen of the solenocyte trees, and reabsorption may take place in the nephridial sacs and the excretory duct.

References: Apel, W., 1885: *Zeitschr. wiss. Zool.*, 42:459-529; Ehlers, E., 1862: *ibid.*, 11:205-252; Lilling, K.H., 1940: *ibid.*, 153:136-180; Moltchanov, L.A., 1908: *Bull.Acad.Imp.Sci. St-Petersbourg*, VI.Ser.Tome 2, vol.1:957-967.

PROTRACTION AND RETRACTION OF OPHIUROID TUBE-FEET. Jeremy Woodley, Dept. of Zoology, University of Oxford, England.

In the water-vascular system of ophiuroids, the absence of tube-foot ampullae comparable to those of asteroids is striking. Perhaps because the tube-feet are not important in locomotion and because they may show only slight changes of shape, protraction mechanisms have not hitherto been investigated.

Histological examination of nine genera of ophiuroids has shown that the foot musculature, although entirely longitudinal, is more or less differentiated into two systems, proximal and distal. The proximal one, which is in that part of the tube-foot within the arm, is the functional equivalent of the ampulla of other classes of Echinoderms, antagonistic to the longer muscles which retract the foot.

When the foot retracts, the expansion of the "ampulla" is limited by the surrounding ossicles. The full retraction of long feet is obtained in many species by forcing excess fluid into the radial water canal. The elastic reaction of the canal forces water back into the foot at the first stage of protraction. In these animals, the valve which otherwise maintains pressure within the foot is equipped with muscle fibres which can open it. Secondly, the radial canal is partitioned by muscular sphincters so that each pair of tube-feet can operate independently.

The histological details of these systems illustrate differences in the capabilities of tube-feet from different regions of an arm or in different species. Some ophiuroids whose tube-feet are able to extend considerably have further modifications to deal with the extra hydraulic fluid expressed from the tube-feet on retraction. The radial canal segments may themselves be capable of great inflation, or vesicles accessory to the canal may expand into special cavities in the vertebral ossicles.

It is suggested that the basic ophiuroid protraction device may have been present in their somasteroid ancestors.

FACTORS CAUSING VARIATION IN THE STATOBLASTS IN LOPHODELLA.  
Shuzitu Oda, Biological Laboratory, St. Paul's University, Tokyo,  
Japan.

Statoblasts are a kind of bud formed asexually in freshwater Bryozoa and their characteristics are very important for the classification of freshwater Bryozoa. Variation in these characteristics is very common. Hitherto, however, the problem of the factors which determine the variation of the statoblasts has not been solved experimentally, because it is very difficult to rear a colony of freshwater bryozoans for a long time under laboratory conditions.

Recently we made studies on the variation of the statoblasts of Lophopodella carteri occurring in Japan. We observed a remarkable tendency for the number of spines at both ends of the statoblast, as well as its shape, to change with the seasons in nature. Therefore, in order to investigate the influence of temperature on the formation of the statoblast, we attempted to rear colonies at various temperatures such as 30°, 25°, 20°C and others, and succeeded, at last, in rearing colonies under such conditions. Zooids germinated from the statoblasts and colonies grown from them were attached to a glass slide and were reared in a small glass aquarium which was kept in a large aquarium thermostatically controlled at a given temperature. The water in the small aquarium was replaced every day with fresh pond water rich in floating flagellates, which are food for bryozoans.

Our experimental results proved that there is a remarkable correlation between the temperature of the water in which the colonies were kept and the number of spines on the statoblasts formed in those colonies. That is, at higher temperatures the number of spines is fewer, definitely increasing with decreasing temperature. Also, measurements showed that, as the temperature is decreased, the lengths of both axes, long and short, of the whole statoblast increase, and the value of the ratio between the two axes becomes gradually smaller. Thus there is a tendency to change shape from spindle to ellipse to square with decreasing temperature. Statoblasts nearly circular in shape and bearing large numbers of spines along the entire border were released from colonies kept at 10°C. Moreover, it was shown that the temperature-sensitive time in the developing statoblast is before its disciform stage.

As to any hereditary tendency in the variation of the statoblasts, we had no clearly indicative results. However, in addition to the above observations, it was noted that the number of spines on the statoblasts released from old colonies was somewhat larger than that released from relatively younger colonies, when they were reared at the same temperature, especially at lower temperatures.



XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

1C. INVERTEBRATE ZOOLOGY

Observations on the snails drilling young bivalves of *Tapes philippinarum*. Choi, Ki Chul, Dept. of Biology, College of Education, Seoul National University, Seoul, Korea.

The present observations on the perforation bored into young bivalve *Tapes philippinarum* (less than 2mm in shell length) by boring snails were conducted at Sun-Jae Island in 1960 and IN-CHON Harbor in 1962.

1. Young bivalves of the species which were left with bored holes in them were found both in IN-CHON Harbor and Sun-Jae Island.

2. The location of the holes in the valves of the young bivalve varied widely, while the holes of the adult bivalve were located at relatively definite position in the valves.

3. The author realized that the holes are bored by a species of snails that have radulas, for the inner diameters of the holes were much smaller than their outer diameters.

4. The size of the holes in the valves of young bivalve was much smaller than those holes bored in adult valves. The minimum size of the holes was only 7.5 micron in diameter.

5. The author considered that the boring snail is *Natica severa* that is found abundantly in IN-CHON Harbor and Sun-Jae Island and that this snail is the only species found in the particular areas and performs the above mentioned behavior. The author could confirm experimentally the snail drilling young bivalves of *Tapes philippinarum*.

THE FILTER FEEDING MECHANISM OF BIVALVES, A CONSTANTLY WORKING ENGINE OR A CONTROLLED BEHAVIORAL ACTIVITY ?

By CARL SCHLIEPER (Institut für Meereskunde, KIEL, Germany)

A considerable number of marine invertebrates employ a filter mechanism for obtaining minute food particles from the surrounding medium. Many details of how these filtering mechanisms work are carefully analysed. But we know very little about an eventual regulation of the filtering rate in relation to the food contents of the external medium. The investigators mostly assume "steady feeding rates". I cannot believe that such a feeding habit would be very economically. We therefore have investigated the feeding mechanism and behavior of the mussel Mytilus edulis in this relationship (SCHLIEPER, KOWALSKI, FLUEGEL, THEEDE, "Kieler Meeresforschungen" 1958-1963).

We have measured separately the ciliary beating of the gill epithelium, the pumping rate and the filtering rate under various conditions. We observed that those three activities change very quickly in response to alterations of the external medium. In each moment the absolute rates are depending from cellular and nervous reactions, stimulations and inhibitions. This is valid as well for the ciliary activity of isolated gill pieces as for the behavior of whole animals. Starving intact mussels in pure food free sea water display decreasing pumping and filtering rates together with a smaller opening of the valves. Mechanical stimuli, by touching or moving the mussels or by an incipient water current, immediately cause a temporary broader opening of the valves and a considerable increase of the pumping and the filtering rates, lasting one to several hours. Feeding of the mussels, for example by addition of soluble nutrients (as glucose etc.) to the external medium, induce longlasting increases of the pumping and the filtering rates.

These results mean, that Mytilus, a very common bottom living filter feeder, can indeed regulate efficiently and purposefully the working of its feeding mechanism in relation to the food contents of the sea water.



ETUDE EXPERIMENTALE DE LA REGENERATION DU TENTACULE OCULAIRE  
CHEZ ARION RUFUS. Monique Chétail, Laboratoire d'Anatomie com-  
parée, Faculté des Sciences de Paris, France.

L'étude histologique préliminaire a montré que le régénérat comporte 2 feuillets, un exoblastème et un endoblastème, qui diffèrent par leur origine, leur mode de division et leurs dérivés. Pour confirmer ces résultats, une étude expérimentale a été entreprise dont voici les conclusions :

Des injections de colchicine et de bleu trypan administrées à des Arion en cours de régénération provoquent une crise Caryoclasique dans l'exoblastème où les mitoses amorcées dégèrent en pycnoses. Si l'on poursuit les injections durant la morphogénèse, la régénération des organes sensoriels est inhibée ou pour le moins déficiente : l'oeil et les organes olfactifs régénérés proviennent donc bien des mitoses de l'exoblastème. Par contre, l'absence d'action mitoclasique de la colchicine et du bleu trypan sur l'endoblastème est un argument en faveur de l' Amitose comme mode de multiplication cellulaire dans ce feuillet, argument qui est renforcé par la morphologie des noyaux et l'opinion analogue émise par plusieurs auteurs au cours de la régénération de divers tissus dans d'autres groupes.

De l'encre de Chine et des colorants vitaux (carmin et bleu trypan) injectés à des Arion en cours de régénération tentaculaire mettent en évidence les propriétés d'athrocytose de certaines cellules de l'endoblastème (macrophages et histiocytes). Par contre, jamais les cellules de l'exoblastème n'athrocytent les colorants vitaux : il ne s'agit donc pas de cellules histiocytaires.

En soumettant le tentacule à des traumatismes divers, imaginés grâce au mode de rétraction de cet organe, on peut obtenir séparément chacun des 2 feuillets du blastème, rendant ainsi évidente l'origine de chacun d'eux : l'exoblastème provient par mitose de l'épiderme cicatriciel; l'endoblastème provient de la mobilisation sous l'exoblastème et de la division directe des cellules émigrées des tissus lésés par l'ablation tentaculaire, à l'exception de l'épiderme.

En résumé, dans l'exoblastème la mitose joue un rôle prépondérant et la morphogénèse est limitée à ce feuillet, il s'agit de régénération par épimorphose; au contraire, dans l'endoblastème il y a remodelage des parties anciennes et la morphogénèse s'effectue grâce à une réutilisation des éléments histologiques récupérables, il s'agit de régénération par morphallaxis.

THE REPLACEMENT OF THE MOLLUSCAN RADULA. N.W. Runham, Dept. of Zoology, University College of North Wales, Bangor, Caerns.

Many theories have been propounded to account for the replacement of the worn out molluscan radula. It is generally agreed that the radula is probably:- secreted by the odontoblasts, altered chemically and physically by secretions from the superior epithelium of the radular gland, is replaced continually, moves forwards continually into the buccal cavity, and is eliminated in some way. In a recent paper the author has determined the rate of radula replacement in Lymnaea stagnalis (2.9 teeth rows/day), and this work has been extended lately to 3 other species (Littorina littorea, Helix aspersa, and Arion ater) by K. Isarankura working in this department.

Subsequent work by the author has been concerned with the mechanism of replacement using tritiated thymidine to label the nuclei of the radular gland epithelia, it has been shown that adjacent to the odontoblasts there is a proliferation zone giving rise to the superior and inferior epithelia. The superior epithelium moves forward at the same rate as the radula, but the inferior epithelium does so initially at a quarter of the rate of the radula in Lymnaea stagnalis. The cells of the inferior epithelium then flatten considerably, and it is suggested that they then move forward at the same rate as the radula. The supralateral radula tensor muscle is attached to the region of flattened cells.

At the anterior end of the two epithelia the cells die and disintegrate - the superior epithelium where it abuts on to the collostylar hood, and where the inferior epithelium joins the general epithelium lining the buccal cavity. It is suggested that the radula is moved forward by the movement of the epithelia.

A study of the cytology of the radular glands of other molluscs, i.e., Patella vulgata, Helix pomatia, Scaphander lignarius, Archidoris pseudoargus, suggests that there is a similar mechanism of radula replacement in these species also. It is possible that this mechanism is a general one.

STRUCTURE AND FUNCTION IN THE DIGESTIVE GLAND OF A MARINE SNAIL  
AGLAJA DIOMEDEA BERGH (OPISTHOBRANCHIA-CEPHALASPIDEA).

J. J. Gonor, Institute of Marine Science, University of Alaska  
 College, Alaska

The histophysiology of the digestive epithelium was studied by submitting animals to feeding and starving regimes prior to in vivo study or fixation for histochemical and cytological work.

Partially digested, liquified food enters the lumina of the gland tubules by contractions of the crop. Food vacuoles quickly form in the digestive cells, the only cell type in which intracellular digestion takes place. During the uptake of fluid protein food, the appearance of these cells is suggestive of pinocytosis. No phagocytosis of particles was seen. Normally, most digestive cells are in similar stages of digestion but may be very arrhythmic in an animal fed often. Starvation produces synchrony in these cells. No cytological evidence of secretion was seen, but these cells discharge remnants of food vacuoles.

A secretory cell type produces distinctive spheroidal secretory bodies which are discharged into the lumen by a peculiar holocrine mechanism just after feeding. During early stages in the accumulation of the secretion, these cells have a very different shape, a brush border and several flagellae (1-3). There is no co-ordination of flagellar beat between cells so that no currents are produced.

Large pyramidal cells showing no direct relation to feeding or starvation are found in graded sizes and appear to slough into the lumen infrequently. They contain subapical aggregates of birefringent spherules, probably of  $\text{CaPO}_4$ , but also containing ferric iron. These cells are cytologically complex, showing aggregates of membrane like structures and large mitochondria. The pyramidal cells resemble in all important points the calcium cells of the pulmonate digestive gland.

The digestive cells appear to be persistent. The secretory cells vary greatly in number, present, and stage. They discharge by liberating into the lumen most of the cell as a large ball packed with spherules and a pycnotic nucleus. The ball quickly breaks up in the lumen. Prolonged starvation brings most of these cells to maturity and eventually to discharge. Maturation stages can be traced to a small cell stage without secretion which are localized surrounding the pyramidal cells. Mitotic figures were found in these loci in adult animals. It is probable that the secretory cells are constantly being produced and are not persistent.

Amebocytes appear to play no role in either digestion or uptake of food in the digestive gland.

A basketwork of fine muscle fibers, outside the collagenous sheath under the epithelium, apparently aids in emptying the lumen.

SHELL STRUCTURE OF FOSSIL AND RECENT PATELLOID ARCHAEOGASTROPODS.  
Copeland MacClintock, Peabody Museum, Yale University, New Haven,  
Connecticut, U.S.A.

The presently accepted suprageneric classification of recent patelloid gastropods is based largely on radula and gill morphology, with relatively little emphasis placed on the shell. General shell morphology cannot be used because most shapes are repeated in each of the major taxa. Bøggild (1930) defined the major kinds of shell structure and described the shell structure of 15 patelloid species. He concluded that only after further work on the group would shell structures be useful in their classification. Three major types of shell structure are recognized here: (1) Prismatic - major and minor prisms oriented at an angle greater than  $10^\circ$  to growth planes; (2) Foliated - thin sheets of calcite intersecting growth planes at an angle less than  $10^\circ$ ; (3) Crossed - crossed-lamellar and complex crossed-lamellar of Bøggild, and crossed-foliated, here defined as similar to crossed-lamellar, but with a lower angle of cross of 2nd order lamellae and wider 1st order lamellae. Shells examined are composed of from four to seven shell layers, depending on the species. Each layer has a characteristic structure. Variations of these structures and different sequential combinations of layers are the basis for the 16 groups listed below. These groups usually conform to, but occasionally cut across previously accepted taxonomic boundaries. Shell structure of 112 species, in section normal to shell and adapical from muscle scar, is generalized as follows [dorsal surface of shell is to left: ccf, concentric crossed-foliated; ccl, concentric crossed-lamellar (concentrically arranged 1st order lamellae); fi, fibrillar; fo, foliated; h, homogeneous; itf, irregularly tabulate foliated; m, prismatic myostracum (muscle-scar shell layer); p, prismatic; rcf, radial crossed-foliated; rcl, radial crossed-lamellar (radially arranged 1st order lamellae); xcl, complex crossed-lamellar; +, and/or]:

1. 2 Acmaea: [?p / fi / ccl / rcl / m / rcl]
2. 3 Acmaea: [? / fi / ccl / h / m / rcl]
3. 6 acmaeids: [p / fi / ccl / m / rcl+xcl]
4. 5 Acmaea: [p / ccl / m / rcl+xcl]
5. 37 acmaeids: [p / fi / ccl / m / rcl]
6. 1 Acmaea, 1 Lepeta: [p / fo / ccl / m / rcl]
7. 18 Cellana, 1 Helcion: [p / fo / rcl / m / rcl+xcl]
8. 1 Cellana: [p / fo / itf / rcl / m / rcl+xcl]
9. 4 Nacella: [p / fo / m / fo]
10. Patella: [rcf / ccf / ccl / m / rcl+xcl]
11. 4 patellids: [p / ccl / m / rcl+xcl]
12. 8 patellids: [p / ccl / rcl / m / rcl+xcl]
13. 5 Patella: [rcf / ccf / ccl / m / rcl+xcl / rcf]
14. 1 Patella: [rcf / ccl / m / rcl+xcl]
15. 5 patellids: [?rcf / ccf / rcl / m / rcl]
16. 1 Helcion: [ccf / ?xcl / m / xcl / fo+rcf]

**THE ORIGIN AND EVOLUTION OF THE MOLLUSCS OF THE BLACK SEA.**  
Prof. Dr. Alexandru v. Grossu, Faculty of biology, University  
of Bucharest, Romania.

Understanding the formation of the Black Sea is prerequisite to understanding and interpreting the characteristic features of the molluscs of this sea. Palaeontological and geomorphological evidence (Haug, Andrussov, Gillet) is used to define and to trace the evolution of the Pannonian and Aral-Ponto-Caspian Basins of the former Sarmatian Sea which, by the beginning of the Tertiary, covered the major part of Europe. Initially the faunal elements of these Basins were rather similar, i.e. they represented a brackwater fauna, but tended to differ in their later evolution. The separation of the Pontic Basin, which was later to become the Black Sea, was responsible for the appearance of a characteristic fauna whose evolution appeared to be differently oriented from the remaining two as through the breaking of the Bosphorus the Pontic Basin was connected with the Mediterranean during the Quaternary. After the connection occurred, a series of epirogenetic movements caused periodical variations in the salinity of the Pontic Basin which led, for a brief period, to a reconnection with the Caspian Basin (Muratov, Arkhangel'ski, Strakhov). The changes in salt concentrations as well as the successive penetrations of the Mediterranean fauna have conditioned the interesting variations which occurred in the malacological fauna.

Faunal studies and characterizations concerning the Pontic Basin made by numerous authors (Zernov, Ostroumov, Knipovitch, Murray, Antipa, Borcea) all point out to the distinct origins of the various species now in existence (relict fauna and Mediterranean fauna), while more recently works by Vodianitzki, Vinogradov, Băcescu and Valkanov brought new and interesting evidence accounting for their changes.

Low salt concentrations, temperature and currents in the above mentioned Basin are responsible for a certain character of these molluscs, which distinguishes them from the Caspian species of which only a few having suffered some changes occur in this Basin, whereas from the species migrated from the Mediterranean only euryhaline and eurythermic species are found. Even in the latter (or at least in some of them) alterations may be observed which could lead to new subspecies or even to independent species. Stenohaline elements, which are now found only in the Bosphorus area, repeatedly and periodically penetrated and maintained themselves in the Pontic Basin. The low number of species migrated as against those living in the Mediterranean, and the present distribution of relict species are accounted for by the character of the physicochemical factors.

The Pontic Basin offers indeed the picture of a vast laboratory in which the malacological fauna has suffered very interesting changes during a relatively short period, not much remote from our time.

MORPHOLOGICAL AND PHYLOGENETIC CONSIDERATIONS ON BRACHIOPODA  
BASED ON ANATOMICAL STUDIES ABOUT SHELL AND BODY-WALL FORMA-  
TIONS. Dr. Andrés de Haro, Laboratorio de Zoología, Facultad de  
Ciencias, Universidad de Barcelona. Spain

The study of body-wall and its derivatives on Brachiopoda show anatomical formations whose complexity is gradual on different families. Rhynchonellidae (Testicardinia) are related with Crania (Ecardinia) by its pyramidal cells in mantle epithelium. By the acidophil protidic substance in the mantle's mesenchyme, Rhynchonellidae (Tegulorhynchia nigricans), are clearly in relation with the remainder Testicardinia. In the structure and composition of the shell, there is a gradual diminution in giobertite in the way Crania anomala---Tegulorhynchia nigricans---Terebratulina caput-serpentis and a gradual increment in calcite in the same sense. Lingula and Glottidia have no cristallised salts in their shells and therefore in this aspect they are far from Crania. In the papillae of Testicardinia there is a gradual increment in the acidophilic substance in the way Terebratulidae (Terebratulina caput-serpentis)---Terebratellidae (Megathyris detruncata). In the stalk of Testicardinia there is cartilaginous capsules and increment of chondroitinsulphuric acid in the way Rhynchonellidae---Terebratulidae---Terebratellidae. The adductor muscle is clearly striated in Testicardinia, except in Megathyris detruncata, therefore the striation has a physiological and not morphological value.

Final considerations. By the organisation and physiological properties of the shell and body-wall, there are affinities and gradual differentiation of mantle, papillae, stalk between Crania---Rhynchonellidae---Terebratulidae---Terebratellidae. Among Ecardinia, Lingula and Glottidia are far from Crania. Mesenchyme of mantle in Brachiopoda has a great resemblance with the mesenchyme under epidermis of Chaetognatha and in both is of ectodermic origin.

The striated musculature presents different periods in Brachiopoda and Chaetognatha, therefore, if there is some relations between them, the striation is independent in origin and if Chaetognatha derive from Brachiopoda, it must be from the primitiv Testicardinia that they must have their origin, as shows the hermaphroditism of Chaetognatha and absence of anus and cilia in larva.

**LES SILLONS DE LA CARAPACE DES DECAPODES MACROURES ET L'EVOLUTION DES SEGMENTS ANTERIEURS.** Sylvie Secretan, Institut de Paléontologie, Muséum National d'Histoire Naturelle, Paris, France.

Toutes les lignes de contact entre l'endosquelette et la carapace correspondent à des sillons. Des régressions évolutives de l'endosquelette, au cours de la céphalisation, auraient réduit le nombre de ces lignes de contact. Aussi subsiste-t-il des sillons qui ne correspondent pas à des contacts actuels entre endosquelette et carapace. Ils en seraient toutefois les vestiges. Il y aurait équivalence entre les sillons inscrits sur la carapace et les sillons intersegmentaires thoraciques. La "courbure céphalique", dont les effets s'observent encore sur ces derniers, explique la position oblique des premiers.

Le bord latéro inférieur de chaque segment thoracique correspond exactement au bord de sa cavité arthrodiale. Le premier segment thoracique dont le bord latéral soit libre sous la carapace est celui de Pmx3. La cavité arthrodiale qui se trouve, sous la carapace soudée, immédiatement antérieure à celle de cet appendice porte la maxille mx2. La zone de carapace qui surmonte cette cavité recouvre donc, ou remplace, la paroi latérale du segment maxillaire. Ceci implique la disparition latérale des segments porteurs du premier et du second maxillipède qui devaient, primitivement, séparer le segment maxillaire du segment de Pmx3. La position médiane des cavités arthrodiales de ces appendices confirme cette hypothèse.

La même observation implique la migration vers la ligne médiane du segment porteur de la maxillule mx1. Des Erymaidés du Secondaire, par la trace latérale partielle de ce segment invisible chez les actuels, suggèrent que cette migration était alors en cours.

On reconstitue donc intégralement la succession segmentaire sous la carapace. On peut ainsi identifier les sillons reproduits sur celle-ci comme étant les empreintes de sillons intersegmentaires de segments parfois non successifs mais rendus jointifs par la migration médiane de segments intercalaires.

L'observation, sur des spécimens actuels de familles variées, des divers degrés de coalescence de la carapace et de la face latérale du segment maxillaire, jointe au mode de fusion et de migration des segments céphaliques et thoraciques antérieurs exposé précédemment, suggère l'hypothèse de l'indépendance primitive du corps segmenté et de la carapace. L'accrolement de la carapace sur les segments préalablement céphalisés se serait effectué secondairement.

Une double origine de la carapace, en coquille bivalve chez les Homarides qui possèdent un sillon longitudinal médio-dorsal à aspect de charnière, et monovalve chez les Palinurides qui en sont dépourvus, est à envisager.

THE PERICARDIAL SACS OF TERRESTRIAL CRABS. Dorothy E. Bliss,  
The American Museum of Natural History, New York, N.Y. and  
Albert Einstein College of Medicine, New York, N.Y.

The pericardial sacs of crabs are two spongy, whitish organs that lie on either side of the body and extend from the posterior portion of the branchial chambers to the beginning of the abdomen. They are continuous with the pericardium and, like the gills, are bathed by the external medium. They have highly convoluted cuticle and epidermis, considerable vacuolated connective tissue, many blood lacunae, and numerous bands of striated muscle fibers oriented in many directions.

Determinations of surface area were made on the pericardial sacs of six species of crabs. In general, the data obtained confirm conclusions based on gross morphology, namely, (1) that the terrestrial crabs *Gecarcinus lateralis*, *Cardisoma guanhumi*, and *Ocypode quadrata* have larger pericardial sacs than have the marine crabs *Callinectes sapidus*, *Cancer borealis*, and *Cancer irroratus*, and (2) that *G. lateralis* has the largest pericardial sacs of all.

In the three species of terrestrial crabs the pericardial sacs extend laterally into the branchial chambers where the gills overlap them, the overlap being considerable in the case of *G. lateralis*. In *C. guanhumi* and *G. lateralis* each pericardial sac also has a postero-ventral extension. Its tip is fringed with setae and lies close to an external tuft of setae extending along the lateral margin of the first three abdominal segments.

*Gecarcinus lateralis* has been kept in the laboratory for periods up to two years with sand moistened with tap water as the only source of water. Our observations indicate that uptake of water from a moist substratum may be the normal mode of fluid intake. Through capillary action the water in moist sand appears to be conducted by the external tufts of setae and along setae-lined channels (formed by adjoining segments) to the postero-ventral extensions of the pericardial sacs. Here, presumably by simple diffusion or by active uptake, the water appears to enter the pericardial sacs.

Just prior to ecdysis, water uptake and retention in *G. lateralis* are intensified and the pericardial sacs may swell enormously. These processes appear to be environmentally regulated (inhibited by constant light, promoted by constant darkness) through the medium of the neurosecretory system.

The portion of each pericardial sac of *G. lateralis* that extends into the branchial chambers is notable for its thin cuticle and its many blood spaces. Conceivably water may pass from the hemolymph to the cells of the pericardial sacs and thence through the cuticle into the branchial chambers. Transpiration of this sort would result in a high relative humidity in the branchial chambers and a low rate of evaporation of water from the lining epithelial membrane and from the gills.

Through their apparent capacity to absorb water from a moist substratum and to reduce evaporation of water from the gills, the pericardial sacs of *G. lateralis* may have played an important role in the adaptation of this species to its dry terrestrial environment.

This work was supported in part by research grants (G-4006 and G-11254) from the National Science Foundation.



PHYLETIC RELATIONSHIPS WITHIN THE PAGURIDEA (CRUSTACEA, ANOMURA)  
SUPPORTED BY LARVAL STUDIES. Anthony J. Provenzano, Jr.,  
Institute of Marine Science, University of Miami, Florida,  
U. S. A.

The hermit crabs and their near relatives constitute a crustacean group of remarkable morphological diversity and have been especially favored subjects for the study of adaptive evolution. Many of the members of this group are so poorly known that their position in relation to others is obscure. Classification of the pagurine anomura long has been unsatisfactory but recently a revised classification based primarily upon studies of larvae was proposed. For less than 5% of the species described is there a minimum of information concerning any early developmental stage, but the reclassification is supported by adult morphology, and ecological and geographical patterns of distribution.

Carcinization and other specializations in the adult stages concerned with ecological niches have been achieved a number of times in the various families of pagurine crabs. The somewhat more conservative larval stages which are all planktonic and hence inhabit a more uniform environment presumably may reveal clues to systematic relationships within the group. Larval characters which are themselves adaptive features for planktonic life must be sorted from characters of systematic significance. Lack of techniques for rearing larvae of known adults from hatching to metamorphosis has been the major factor inhibiting developmental studies and evaluation of larval characters. Recent advances in laboratory methods have made possible the rearing of representatives of a growing number of genera.

Despite the relatively small number of species which have been studied it is possible to make preliminary evaluation of a number of larval characters which at present appear to be of familial, generic or specific value.

THE RELATION OF EGG PRODUCTION TO FOOD UPTAKE IN TIGRIOPUS BREVICORNIS. G. W. Comita and J. J. Comita, Dept. Zoology, North Dakota State University, Fargo, North Dakota, and The Scottish Marine Station, Millport, Scotland.

Pheodactylum tricornutum was fed to Tigriopus brevicornis in concentrations of 0, 1, 10, 50 and 100 cell/mm<sup>3</sup>, replenished daily, and maintained at approximately 110C. At the 0 and 1 cell/mm<sup>3</sup> levels, egg production stopped after 1 and 2 days; at the 10 cell/mm<sup>3</sup> level it stopped after 9 days; and at the 50 and 100 cell levels it continued at a constant rate, being about 5 eggs/day at the 50, and 10 eggs/day at the 100 cell levels. The mean number of eggs/sac increased with each sac produced for the 50 and 100 cell/mm<sup>3</sup> level.

The number of fecal pellets produced was proportional to cell concentration of the algae.

Egg production by animals fed 100 cells/mm<sup>3</sup> at three temperatures showed that there was little difference between the number of eggs/sac at 10°, 15° and 20°C, but more egg sacs were produced at the higher temperatures. The time required for hatching varied from 10.2 days at 10°, to 4.9 days at 15°, to 3.1 days at 20°C, which is in accord with other data of this kind taken on fresh-water calanoids.

P<sup>32</sup> was traced from algae to eggs and was detectable in all eggs produced as distant as the seventh sac after only one feeding of labelled algae. For 17 days after feeding, about 38% of the P<sup>32</sup> was traced to eggs, 35% in the body, and the remaining 27% was accounted for by difference as excretion and egestion. The P<sup>32</sup> may have depressed egg production. The first sac produced after one feeding with P<sup>32</sup>-algae contained about half the number of eggs/sac as compared with the succeeding sacs, and with those produced by animals fed nonirradiated algae.

THE STATUS OF ENTOCYTHERID OSTRACOD RESEARCH IN THE UNITED STATES AND MEXICO. C.W.Hart, Jr., Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania, U.S.A.

Entocytherid ostracods are commensal on crayfishes in North America, and since the first entocytherid ostracod, Entocythere cambaria, was described by W. S. Marshall in 1903, fewer than 100 species have been described. This has not been due to a scarcity of new species, but to the fact that they have been overlooked in the detritus from crayfish collections, where they tend to accumulate.

The subfamily Entocytherinae has recently been revised (Hart, C.W., Jr., 1962, Proc. Acad. Nat. Sci. Philadelphia 114(3):121-147) to include 10 genera -- Ankylocythere, Ascetocythere, Cymocythere, Dactylocythere, Donnaldsoncythere, Entocythere (restricted), Geocythere, Rhadinocythere, Sagittocythere, and Uncinocythere -- encompassing those species formerly assigned to the genus Entocythere. Of these genera, Uncinocythere is by far the most ubiquitous. It has been recorded from Mexico northward into Washington and eastward into Florida and the Middle Atlantic states. Several of the other genera are at present known only from one or two localities. Active research in this field is being carried on currently by fewer than a half-dozen workers.

**ФИЛОГЕНЕТИЧЕСКИЕ ВЗАИМОТНОШЕНИЯ ПАРАЗИТИЧЕСКИХ  
ВЕСЛОНОГИХ РАКООБРАЗНЫХ (Copepoda parasitica )**

**А.П. Маркевич, Институт зоологии, Киев, СССР.**

Паразитические веслоногие в своем происхождении связаны, в основном, со свободноживущими Cyclopoida , что позволяет объединять их в одном подотряде. Развитие паразитических Copepoda нашло в нескольких направлениях. Одно из них — через сем. Clausidiidae отходят родственные между собой семейства Artotrogidae , Ascomyzontidae , Lichomoliidae и др.

От форм близких к сем. Coryceidae произошли Caligidae и связанные с ними Dichelesthidae , Lernaеidae, Lernaеopodidae и другие семейства, быстро развивавшиеся в направлении общего упрощения организации. Эти семейства обнаруживая сходство в ряде признаков, приобрели ряд специфических особенностей организации. Семейство Herpyllobiidae не связано в своем происхождении с Choniostomatidae (хотя Giard и Bonnier их объединяли в сем. Sphaeronellidae ). То же относится к сем. Saccopsidae.

Notodelphyoda в своем происхождении также связаны с Cyclopoida , а не с Harpacticoida , как это утверждал Самп. Эволюция нотодельфиоид совершалась в двух основных направлениях: по линии интенсивного развития выводковой камеры и по линии сохранения двух свободных яйцевых мешков.

Семейство Chondracanthidae должно быть включено в подотряд Cyclopoida . С Chondracanthida родство обнаруживают Sphyridae , обычно сближаемое с Lernaеidae . В этом мнении убеждает изучение организации самцов, строения конечностей и полового аппарата самок рода Branchiochondrites установленного докладчиком (Маркевич, 1940).

ON THE MALLOPHAGA OF EGYPT. By Professor Mahmoud Hafez & M.H. Madbouly, M.Sc. Department of Entomology, Faculty of Sciences, University of Cairo.

A survey of biting lice encountered in Egypt on domesticated birds, resident birds and migratory birds has been undertaken. The lice were collected on birds from different localities of the Egyptian territory in the Nile valley, and in arid, semi-arid and costal zones. Both living and dead birds were inspected for lice infestation and collecting. 61 species of Mallophaga of which 56 were found to be new records for Egypt, were obtained from 36 species of birds. Of these species of lice 8 were collected from 5 species of domesticated birds, 16 from 10 species of resident birds and 37 from 21 species of migratory birds. The 61 species of lice belong to 31 genera under the two main suborders of Mallophaga namely Amblycera and Ischnocera. From Amblycera the family Menoponidae is represented by 12 genera and 22 species, while the family Philopteridae of the Ischnocera is represented by 19 genera and 39 species.

A tentative key for the genera of each suborder has been made together with detailed morphological descriptions of the species of lice recorded. A systematic list of birds and their Mallophagan parasites is also given.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

1D. ROLE OF ECTOCRINES  
IN INTERACTIONS OF AQUATIC INVERTEBRATES

Organized for the Division of Invertebrate Zoology  
of the American Society of Zoologists

by

F. A. Aldrich

Memorial University of Newfoundland  
St. John's, Newfoundland

OYSTER NUTRITION AND ORGANIC MATERIALS. Albert Collier,  
Oceanographic Institute, Florida State University, Tallahassee,  
Florida.

The ecological status of the oyster is reviewed in terms of its chemical environment. The role of organic materials as components of this environment and as specifically related to oyster feeding and nutrition are discussed.

THE CHEMICAL BASIS OF SUBSTRATE SELECTION BY CERTAIN MARINE  
INVERTEBRATE LARVAE. Dennis John Crisp, Marine Science  
Laboratories, Menai Bridge, Anglesey, North Wales.

Immediately that the cypris larvae of the barnacles Balanus balanoides L and Elminius modestus Darwin alight on a surface they respond to the presence or absence of adsorbed molecular layers. They soon swim off the surface of an inert material, such as slate or plastic, if this is chemically clean. However if the same surface has previously been soaked in a solution of protein extracted from barnacles, the cyprids explore it and many of them settle permanently on it. The soluble heat-stable protein fraction of the cuticle, arthropodin, appears to be the active substance. The arthropodin derived from its own species was found to be the most effective agent but surfaces treated with arthropodins from other species of barnacle or from other arthropods were also found to be attractive to cyprids.

Cyprids did not readily settle on clean surfaces, even when these were offered immersed in a solution of arthropodin, but they settled readily on surfaces that had been soaked long enough to acquire an adsorbed layer of protein. It is believed that the response is evoked by contact with a characteristic molecular configuration formed at the surface of an adsorbed layer of soluble arthropodin or at the surface of the tanned arthropodin of natural cuticle but not by contact with the protein in the dissolved state. The mechanism of this specific response to a material in an insoluble form is not yet understood.

Other marine larvae at settlement show a similar recognition of macromolecules specifically associated with their normal habitats.



THE ROLE OF ECTOCRINES IN ANIMAL ASSOCIATIONS. Demorest  
Davenport, Department of Biological Sciences, University of  
California, Santa Barbara, University, California.

Recognition by symbionts of specific chemical signs from their hosts has been known for some time to be frequently of great importance in maintaining association. The perception and recognition of such specific signals by symbiotic larvae or adults often serves as a trigger mechanism to release many sorts of positive (i.e. host-finding) adaptive behavior. If we extend the breadth and significance of our definition of symbiosis to include prey-predator relationships, such signs can also be seen to serve an important function as triggers of highly adaptive negative (i.e. predator-escaping) responses. Examples can be seen within a single lower invertebrate phylum such as the Coelenterata, where some sea anemones recognize and respond positively to precise signals from the shell of their hermit crab hosts and others "recognize" and escape by swimming away from predacious nudibranchs etc. The existence of this recognition may explain many types of behavior not hitherto understood, such as that of actinians or siphonophores in harboring fish. That precise recognition by the Coelenterate, possibly of specific substances released by the commensal, may account for the failure of the stinging host to harm its commensal can no longer be doubted.

These mechanisms are not so important descriptively as they are in providing tools with which the behavior itself can be investigated and its physiological control elucidated. One would not have expected that the first real demonstration of specific recognition in an actinian (by Yentsch and Pierce) would have led to the establishment (by Robson) of the importance of a physiological "center" or "pacemaker" (controlling the behavior) in what has previously been thought to be the relatively simple non-polarized actinian nerve-net. This may well be carried further to a demonstration of classical conditioning in a net-innervated system in which the ectocrine triggering a precise response may be used as an unconditioned stimulus.

This tool in the investigation of behavior is at times particularly useful because the sources of such ectocrines (hosts, predators, etc.) can be experimentally manipulated in time and space in a way in which many sources of specifically acting stimuli cannot as easily be.

Further examples of the uses of this tool in the investigation of the adaptive tropotactic and klinokinetic behavior of infectious larvae and other organisms (sperms, etc.) are given.

METABOLIC TRENDS ASSOCIATED WITH SUCCESSION IN PHYTOPLANKTON.

Robert Johnston, Dept. of Agriculture and Fisheries for Scotland,  
Marine Laboratory, Aberdeen, Scotland.

Succession of species is a well-marked feature of populations of phytoplankton. In the past a number of interpretations of the phenomenon have been advanced including the familiar theory that growth of one species is necessary to prepare for the next; but there is a lack of biochemical evidence to support the theory.

Enrichment cultures of natural populations show how growth in laboratory and sea conditions differs. Change in the organic substrate of in vitro cultures produces changes in the population structure that are here tentatively linked with natural succession. On the basis of the experimental evidence succession probably involves differences among species both in their external and internal metabolism rather than control by the limitation of or susceptibility towards inorganic nutrients.

THE SWIMMING BEHAVIOUR OF THE SEA-ANEMONE STOMPHIA COCCINEA.  
Elaine Robson, Dept. of Zoology, University of Cambridge, England.

The sea-anemone Stomphia coccinea Muller shows a variable sequence of swimming behaviour after contact either with the predatory nudibranch Aeolidia papillosa L. or with the starfish Dermasterias imbricata Grube, Hippasteria phrygiana Parelius and H. spinosa Verrill. The anemone usually detaches itself, expands, and exhibits sharp rhythmical bending movements which may continue for several minutes. Its total displacement is small and in a random direction unless the water is flowing. The habits and geographical distribution of genera known to cause the response suggest that it may be an escape reaction to Aeolidia which is also evoked by certain starfish. Aeolidia will feed on Stomphia but the significance of the response to starfish is not yet understood.

Aqueous extracts prepared from Dermasterias and Aeolidia evoke vigorous swimming. The active principle from Dermasterias disappears on dialysis or boiling; its nature is being investigated (J. Ward). The substance concerned in Aeolidia is secreted by pedal gland cells. It remains effective after similar treatment but its constitution is unknown. These two substances may act on the anemone through different sensory pathways. Starfish affect the disk and tentacles and usually provoke a contraction of the sphincter muscle, whereas Aeolidia causes swimming on contact with the column alone. The chemoreceptors await further study.

Effective stimuli excite a pacemaker system in the column, by which swimming contractions are maintained. Pacemaker activity may be attributed to some large multipolar nerve-cells scattered throughout the column; from their position and histology they are the elements most probably concerned. Portions of this system are radially equivalent. The partial responses of divided anemones thus present not only the same features as the behaviour of whole animals, but the same problems.

A SEA ANEMONE, A HERMIT CRAB AND A SHELL - AN ECOLOGICAL TRIANGLE.  
D. M. Ross and L. Sutton, Dept. of Zoology, University of Alberta,  
Edmonton, Alberta, Canada.

Observations are described on the association between the European sea anemone, Calliactis parasitica, and the hermit crab, Pagurus bernhardus, which usually lives in a Buccinum shell. Experiments showed that this crab plays no part in establishing the association; the essential factor is a tentacular response by the anemone to the shell. The response is the same whether the shell is occupied, is unoccupied, or never has been occupied, by a crab. This response initiates a complicated manoeuvre during which the anemone detaches itself from one surface and re-settles on the shell.

Tests on shells which had been treated in various ways showed that the anemone's response is due to a chemical "shell-factor", which is found both in the periostracum, and in the shell's non-mineral component. There is evidence that nematocysts are involved in the first response to the shell.

If one compares this association with that between the same anemone and another crab, Dardanus arrosor, the primary role of the anemone in the association is brought out, even though some crabs of this species display great activity in transferring Calliactis to their shells from other surfaces. Some general conclusions are drawn concerning (a) the neuromuscular capacities of sea anemones and (b) infra- and interspecific differences in behavior.

INTERACTION OF A GASTROPOD VELIGER AND BOTTOM SEDIMENT RESULTING  
IN METAMORPHOSIS. Rudolf S. Scheltema, Woods Hole Oceanographic  
Institution, Woods Hole, Massachusetts, U. S. A.

The veliger larvae of Nassarius obsoletus Say have a long planktotrophic life. Metamorphosis is stimulated by a substratum which has sediment favorable for further development of the primarily deposit-feeding juvenile snail. In the absence of such sediment the length of the pelagic larval life may be increased two-fold.

Physical properties such as median grain size and sorting do not directly influence the metamorphosis of the veliger larvae. Rather, certain biological properties are important in making the substratum attractive for metamorphosis. This has been shown by the differences in settlement obtained experimentally when the sediment was treated in a variety of ways.

Incineration of the sediment resulted in removing all properties favorable for inducing metamorphosis; no significant difference existed between the percentage metamorphosis on incinerated sediment and on controls without a substratum of sediment. Other less drastic treatment to the substratum showed intermediate effects between incineration and untreated sediment.

The metamorphosis-inducing properties of the sediment may be transferred to the adjacent water as was experimentally demonstrated. Evidence showed that the metamorphosis-inducing factor from the sediment is a water-soluble substance since filtration of sediment-conditioned sea water through a filter with  $0.8 \mu$  pore diameter did not remove the metamorphosis-inducing factor. It is presumed that the water-soluble substance directs veliger larvae to the appropriate substratum.

The interaction of gastropod veligers of Nassarius obsoletus and bottom sediment greatly enhances the likelihood that the veligers will metamorphose in a favorable habitat.

POPULATION REGULATION BY ECTOCRINES IN CURA FORMANII (TURBELLARIA).  
Bassett Maguire, Jr., Dept. of Zoology, The University of Texas,  
Austin, Texas, USA.

When members of a clone of the Triclad, Cura (=Curtesia) formanii, are fed similar amounts of food and kept together in different sized groups, the number of cocoons produced per worm is inversely proportional to the number of worms per bottle. Aeration produces very little, if any, change in the pattern. This indicates that the inhibition is probably not the result of worm caused changes in the levels of oxygen or carbon dioxide within the culture water.

The inhibitory effect is not decreased by the presence of the pulmonate gastropod, Physa, as is the case with the anti-growth factor produced by tadpoles.

When young worms which have just emerged from cocoons are placed in bottles in groups of 1, 2, or 4 per bottle, assignment to the bottles determined by use of random numbers, and allowed to grow, cocoons appeared in bottles containing only one worm sooner than they appeared in bottles containing more than 1 worm. The probability of the difference observed occurring by chance is less than 0.01. There was no apparent difference in time to the production of the first cocoon in cultures of 2 or 4 worms. Worm length in bottles in which the first cocoon had just appeared averaged 9.94, 11.3, and 11.2mm for worms which had been cultured 1, 2, and 4 per bottle respectively. The size at the time of first cocoon production was significantly different ( $p < .05$  with the one-tailed rank test) between the worms cultured alone and those cultured 2 or more to a bottle.

As the population density increases the time required for a recently emerged young worm to grow to reproductive maturity is increased and the rate of reproduction of the adults is strikingly reduced. This is consistent with the hypothesis that Cura possesses an efficient population regulation mechanism.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

1E. BIOLOGY OF CEPHALOPODS

Organized for the Division of Invertebrate Zoology  
of the American Society of Zoologists

by

Gilbert L. Voss

Institute of Marine Science  
Miami, Florida

INFORMATION OBTAINED BY USING SQUID PREDATORS AS SAMPLERS.  
Malcolm R. Clarke, National Institute of Oceanography,  
Wormley, Godalming, Surrey, England.

Stomach contents of Cetacea, seals, birds and fish have provided much information concerning squids, and their distribution (e.g., work of Joubin and Bouxin & Legendre). These studies have shown that predators often obtain species which have never or rarely been caught in nets and sample a greater size range and size maximum than nets. Geographical range of the species found have also been shown.

The disadvantages of studying stomach contents are that digestive processes have often reduced the squids to unidentifiable fragments and in most stomachs, only beaks remain. This means that a very large number of stomachs must be examined to obtain relatively few identifiable specimens. Although such a collection is desirable it frequently proves impractical and therefore recent work has been directed towards a study of the beaks. Beaks can now be sorted into family groups and often it proves possible to group them into species. After sorting, it is sometimes possible to show that species exist which have not yet been described and that described species have a larger upper size limit than previously realized. The beaks can show the geographical range of named (e.g., Cucoteuthis) and unnamed species and the vertical distribution where this is known for the predator (e.g., birds). They indicate the relative numbers of different species, subject to selection by the predator.

From the beaks we may estimate the weight of the squids, providing the relationship between rostral length and body weight is known for the particular family to which the beak belongs (e.g., Ommastrephidae). Size groups are sometimes present which give a means of estimating growth rates. Stages in the darkening of beaks show the onset of sexual maturity in some and possibly in all species (e.g., some Ommastrephidae).

Collection by predators is biased as indeed is collection by nets. Errors in identification of beaks are more likely than in identification of whole squids. These factors must always be borne in mind when interpreting data from beaks.



THE DISTRIBUTION AND ABUNDANCE OF THE EPIPELAGIC DECAPOD (CEPHALIOPODA) LARVAE IN THE CALIFORNIA CURRENT. John A. McGowan, Scripps Institution of Oceanography, and Takashi Okutani, Tokai Regional Fisheries Laboratory, Tokyo, Japan.

The growth stages of 13 species of squid have been determined by working down from adult specimens to those only a few millimeters long. These small "larvae" are planktonic. Their populations have been studied from a series of 3,895 large plankton tows taken in an area of 360,000 miles<sup>2</sup>, on a monthly basis, for 3 years. All larvae showed seasonal changes of abundance and frequency, but these often differed for different species. Both the frequency and abundance of some species of larvae were greater in offshore areas than nearshore. It was not possible to demonstrate temperature correlations, but a study of the amount of mixing of the waters of the area showed that the two most abundant species of larvae were most frequent and most abundant in waters that were of approximately 80% northern origin.

DISTRIBUTION OF OCEANIC CEPHALOPODS OFF OREGON, U.S.A.  
William G. Pearcy, Department of Oceanography, Oregon State University.

Over 200 midwater trawl collections made throughout the year to various depths down to 1000 m and along three latitudes provided data on the vertical, geographic, and seasonal distribution of small oceanic cephalopods of the northeastern Pacific Ocean off Oregon. A total of 16 different species, including one new species, is reported.

Gonatus fabricii, Abraliopsis spp. and Chroteuthis veranyi, common within the upper 200 m at night, were the most abundant squid in the collections. Galiteuthis armata and large Japetella heathi and Octopodoteuthis sicula were collected only in deeper tows to 500 or 1000 m depth, suggesting that these mesopelagic animals do not migrate into surface waters.

The species composition was similar at three latitudes and indicated little geographic change in the oceanic cephalopod community off Oregon. Marked seasonal differences were noted however. The number of squid in the catches during the summer averaged an order of magnitude higher than those during other seasons. Reasons for the seasonal fluctuations are discussed.

CEPHALOPODS OF THE SAN PEDRO AND CATALINA BASINS.

Gary Hendrix, Institute of Marine Science, University of Miami, Miami 49, Florida.

A sampling program by the University of Southern California for the bathypelagic fauna of the basins off the Southern California coast has been in progress since December 1960. Issac-Kidd Mid-Water trawls have been the means of sampling, and these samples have been rich in fish, crustacean, and cephalopod specimens. This project has provided not only a supply of cephalopod material, which has been heretofore scanty from the Eastern Pacific, but has yielded systematic station data which will be valuable as an ecological measure.

The data provided by this program has led to some preliminary observations as to the day-night migration, seasonal distribution by depth, seasonal occurrence of species, and stratification of cephalopod species in the waters of the basins.

CEPHALOPOD LOCOMOTION. Anna M. Bidder, Dept. of Zoology,  
Cambridge University, Cambridge, England.

Jet-propulsion is the most fundamental and widespread method of locomotion in the Cephalopoda, but this statement needs two qualifications.

(1) The method of jet-propulsion is not always the same: not only is the mechanism of jet-propulsion found in Nautilus fundamentally different from that of the Coleoidea, but a variant of the Coleoid mechanism has recently been described in a cranchid oegopsid.

(2) For a number of coleoid cephalopods, the funnel is not the sole, nor even the principal organ of locomotion, and for others the funnel and its jet are probably only used in respiration and play no part in locomotion.

The various methods of jet-propulsion will be compared. The condition found in Nautilus can be directly related to the presence of an external shell. The extent to which observations made on Nautilus can be applied to extinct shelled cephalopods is still a matter for speculation. The various types of coleoid locomotion include web-swimming and fin-swimming of various types. Some of these must represent a way of life very different from that associated with active jet-propulsion.

BIOLOGY OF *LOLIGO OPALESCENS*. W. Gordon Fields, Dept. of Biology,  
Victoria College, Victoria, British Columbia, Canada.

*Loligo opalescens* is the common squid in the coastal waters of the Pacific Ocean from Mexico to Canada. Its life history was studied at Monterey, California, where spawning schools support a considerable fishery. Squid and their eggs are available there throughout most of the year; major and minor spawning peaks occur in May and November associated with distinct oceanographic seasons.

While eating one crustacean this squid continues capturing others with its tentacles, building up a reserve of active prey within the loosely-held cone of arms; no evidence of the use of cephalotoxin was seen. Stomach contents commonly include crustacea, fish and polychaete worms, with the proportion of crustacean meals decreasing and fish meals increasing in larger animals; squid larger than 120 mm show some cannibalism.

Population data indicate that, at ages of one, two and three years, dorsal mantle lengths are approximately 65 mm, 120 mm and 165 mm for male squid and 65 mm, 120 mm and 150 mm for female squid. Two distinct populations enter the spawning grounds during the year, one being dominant in the earlier and the other in the latter part of the year. The November spawning group apparently migrates from south of Point Conception with the Davidson Current.

Almost all females and most males spawn at age three years, although many males spawn when younger and a few when older. The 1:1 sex ratio of immature squid is repeated in spawning schools. All *L. opalescens* die after one season of spawning.

A severe reduction in average size of the spring spawning stock occurred 1947-1952 and persisted through 1961; various factors suggest a possible relationship between this and the disappearance of the California sardine from waters north of Point Conception.

OBSERVATIONS ON THE BEHAVIOR OF OCTOPUS. F. G. Wood, Jr.  
Life Sciences Department, Naval Missile Center, Pt. Mugu, Calif.

Given proper conditions, the common Atlantic octopus, *O. vulgaris*, adapts readily to captivity, and exhibits behavior patterns that may be assumed to approximate those of feral individuals. *O. vulgaris*, within rather wide limits, is eurythermal and euryhaline (to at least 25 ‰), but is sensitive to other chemical components of the water and to low oxygen. It will eat a variety of fish and shellfish. Longevity of captive specimens at Marineland, Florida, has not exceeded a year. Growth may be very rapid--from 55 gm to 3549 gm in ten months, in one instance.

In the male, sex can be determined by the notch in the web between the 3rd (hectocotylus) and 4th right arms. Mating may occur within two hours of the time a newly caught male is placed in a tank with a resident female. Two males may mate simultaneously with the same female. Mating (in which the tip of the hectocotylus is inserted into the mantle cavity of the female for transfer of the spermatophore) may last for as long as an hour. Egg deposition is imminent when the female prepares a site and repels the male. She eats nothing thereafter. Each egg has a thread-like stalk. A few at a time are ejected from the syphon and woven and cemented together by the suckers surrounding the mouth to form strands up to ten centimeters long. As many as 325,000 eggs may be produced over a period of about two weeks. The first to appear are the first to hatch (three to five weeks later) and hatching also covers a period of about two weeks. This suggests that the spermatophore is retained intact until egg deposition begins, and that the eggs are fertilized at the time they are emitted. The female keeps the eggs clean and well-aerated by running her arms through them and by ejecting water into the strands. A larva generally emits a puff of sepia as it hatches. The larvae are pelagic and strongly phototactic. Most attempts to keep them alive more than a week have been unsuccessful.

In passive defence, an octopus backed into a corner will blanch when threatened, and assume a posture in which the mouth and sucker side of the back-curved arms are presented. Jets of water are ejected from the funnel toward the threatening object. If further molested, sepia may be ejected forming a "smokescreen" which (in another species) reportedly deadens the sense of smell of the moray eel, a common predator. In open water an octopus takes refuge in flight, blanching to inconspicuous paleness and emitting an octopus-sized blob of sepia. If handled, an octopus may bite with painful results due to the posterior salivary gland secretion.

**FUNCTION AND COMPARATIVE MORPHOLOGY OF THE FUNNEL ORGAN IN CEPHALOPODS.** Gilbert L. Voss, Institute of Marine Science, University of Miami, Miami 49, Florida.

The cephalopodan funnel organ or Verrill's organ is poorly understood and its comparative morphology has largely been ignored. The organ is usually W shaped in the Octopods but in the Sepioidea and Teuthoidea is three parted, consisting of a dorsal inverted V shaped main organ and paired lateral or ventral pads. From histological examination the organ is found to be composed of long goblet cells whose function is to produce mucus. It is assumed that by the excretion of mucus it aids in clearing the funnel of foreign material during periods of inactivity or in areas where considerable material living or dead is in suspension in the water.

In the Octopods the funnel organ is usually W shaped and departures from the norm consist in separation of the limbs of the W or in some cases of parallel bars. In the Sepioidea little variation is found in the shape of the dorsal element. This is also true for the myopsid teuthoids but in the Oegopsida considerable specific variation is found, reaching its greatest complexity in the Cranchiidae. The variations of the funnel organ are considered to be of considerable value in taxonomic and growth studies.

COMPARATIVE INTERNAL ANATOMY OF VAMPYROTEUTHIS INFERNALIS.  
Richard E. Young, Institute of Marine Science, University  
of Miami, Miami 40, Florida.

Vampyroteuthis infernalis is the sole known representative of the archaic order Vampyromorpha. Studies on the internal anatomy of this animal have further substantiated its primitive nature. Of particular interest in this regard is the "incomplete" structure of the mantle and the presence of a large mantle nerve. This nerve is the functional equivalent of the numerous small nerves which radiate from the stellate ganglion in higher forms, and may be the forerunner of the more advanced condition.

To the list of unique features of this animal, several additions can be made. Among these is the apparent cyclic development of the male reproductive system, the highly complex nature of the statocysts and the functional peculiarities of the hepatopancreas.



DEVELOPMENTAL ANALYSIS OF THE CEPHALOPOD EMBRYO. John M. Arnold, Dept. of Zoology, University of Minnesota, Minneapolis 14, Minn.

There has been a surprising lack of experimental embryological work done on the cephalopods. In this paper two approaches were used to gain information about the mechanism of differentiation in this group. A culture medium of adult squid blood, sterile sea water, and antibiotics has been devised that will support growth of the embryo outside of the chorion. By stripping off the outer layer of cells from the yolk epithelium of Loligo pealii embryos during the appearance of organ anlage, it was found that the yolk epithelium apparently induces the overlying cells to form the primordium of the eye. If the overlying cells and the yolk epithelium were removed together and cultured as an isolate, a complete eye was formed. If reaggregates of dissociated cells were grafted onto freshly stripped epithelium, these cells assumed the fate of, and differentiated into parts of, the organ that would normally be found in that position. It was concluded that the yolk epithelium induces the overlying cells to form the organs above it and that this yolk epithelium has regional specificity.

The egg cortex of embryos in the first cleavage was tangentially irradiated with a microbeam of ultra-violet light. At the time of appearance of the organ anlage these embryos lacked the organs that should have appeared above the irradiated area. If the blastoderm fails to cover the total egg only those organs that would normally develop in the cellulated area appear. Centrifugation experiments have shown the position of the blastodisc to be unrelated to the site of appearance of the organ anlage. It was concluded that the egg cortex serves as a morphogenetic map of "pre-programmed information" and dictates by means of the yolk epithelium where the organ anlage shall be formed.

THE DICYEMID MESOZOA Robert B. Short and Raymond T. Damian, Department of Biological Sciences, Florida State University, Tallahassee, Florida. The dicyemid mesozoans, common parasites of cephalopod kidneys, present unsolved problems relating to their life cycle and taxonomic position. Forty-one species of dicyemids have been described from 27 species of cephalopods in ten genera.

Dicyemids will be illustrated and their life cycle will be briefly discussed. Known hosts and localities will be presented and a method for preparation of material for study will be described.

THE PROCESS OF AMMONIA EXCRETION IN AN OCTOPUS. W. T. W. Potts and A. W. Martin, Dept. of Zoology, University of Washington, Seattle, Washington.

The excretory system of this cephalopod consists of a symmetrical pair of renal organs. The urine originates by the ultrafiltration of blood through the branchial heart appendages into the pericardium. The filtrate drains through the renopericardial ducts into the renal sacs. Glucose is resorbed and phenol red and ammonia are transferred from the blood and concentrated in the urine in the renal sacs. The secretory tissues are arborescent glandular outgrowths on the walls of the lateral venae cavae within the renal sacs, the renal appendages. The blood lies within the renal appendages, the urine outside.

The function of the kidney has been elucidated by the insertion of blood sampling tubes and indwelling catheters in many locations within the renal organ.

Ammonia diffuses from the blood into the urine in the form of the mobile ammonia molecule ( $\text{NH}_3$ ) and is trapped in the acid urine in the form of the ammonium ion ( $\text{NH}_4^+$ ). At the pH of the blood, 7.0 - 7.2, about 1% of the total ammonia exists as the ammonia molecule but at the pH of the urine, 5.1 - 5.5, only about 0.01% exists as ammonia. The degree of concentration of total ammonia ( $\text{NH}_3 + \text{NH}_4^+$ ) in the urine may reach one hundred times that in the blood, but the concentration of ammonia ( $\text{NH}_3$ ) in the urine is always lower than in the blood. The concentration of total ammonia in the urine varies with the acidity of the urine and the concentration of total ammonia in the blood. The carbonic anhydrase inhibitor Diamox<sup>®</sup> partially inhibits the acidification of the urine and greatly reduces the degree of concentration of ammonia.

The pericardial fluid is up to one pH unit more alkaline than the blood and contains less total ammonia. The ammonia is probably removed from the initial ultrafiltrate by the same process as that by which it is added to the final urine. The origin and significance of the high pH of the pericardial fluid is not known.

About one-quarter of the ammonia present in the blood is lost from the lateral venae cavae as a unit of blood traverses the renal sacs, a further loss of ammonia occurs across the ctenidia under the circumstances of these investigations where the aquarium water is at a pH of about 7.5. The pH of the blood alters less than 0.1 pH unit across the kidney and ctenidia together.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

1F. MUCUS IN INVERTEBRATES

Organized for the Division of Invertebrate Zoology  
of the American Society of Zoologists

by

Sophie Jakowska

Food and Drug Research Laboratories, Inc.  
Maspeth, New York

MUCUS IN INVERTEBRATES - INTRODUCTORY REMARKS. Sophie Jakowska,  
27 West 96 St., New York 25, N.Y.

Experience with mucous secretions from mammals indicates the need for a chemical approach to the study of invertebrate mucus. Recent advances in this field are summarized in order to discuss briefly the basic characteristics of mucins and blood group substances, some methods of isolation and purification, and the basis for histochemical procedures currently in use.

Some invertebrates may provide better homogeneous samples of mucus, with minimum extraneous matter, e.g. coelomic micocytes of some annelids. The puzzling insolubility in most solvents of many mucous secretions of higher animals may be better studied in invertebrates that permit direct methods of mucus collection. Some species may be suited for studies on biosynthesis of mucins, just as bacteria contributed to the understanding of these phenomena in mammals. It would be interesting to learn if the basic proteins associated with invertebrate mucins are as rich in serine, threonine and glycine as are the mucins and blood substances of higher animals. A clearer understanding of the relationships of mucopolysaccharides from mucus and from connective tissue may possibly be reached through studies on lower animals; lamellibranch crystalline style is of interest. Studies on invertebrate mucus in terms of immunological relationships of animal groups, as well as host-parasite relations, may prove of value in view of the basic similarity of mucins and blood group substances in mammals.

A number of invertebrates, known as good sources of mucus, are pharmacologically investigated in relation to acetylcholine and related substances; concomitant observations on mucus secretion would be advisable. Land snail has already been used in studies on the effects of air pollutants: mucus secretion of aquatic invertebrates may be used eventually as a criterion of chemical pollution of fresh and sea water. Invertebrates may also furnish better models for studies of mucosal irritants than some of those presently in use. More studies on invertebrate mucus secretion in natural or artificial ecological systems should be encouraged in order to elucidate some factors affecting the rate and amount as well as physical and chemical condition of mucus. It may be of interest to investigate mucins in some forms that exhibit regular sex reversal in view of mucin sex dimorphism occurring in hamster submaxillary glands.

Invertebrate zoology can make an important contribution to this relatively unexplored field.

**CYTOLOGICAL AND CYTOCHEMICAL OBSERVATIONS ON THE MUCOUS GLAND CELLS OF CONVOLUTA CONVOLUTA. Knud Jørgen Pedersen, Institute of General Zoology, University of Copenhagen, Denmark.**

The acoel turbellarian, Convoluta convoluta, is richly provided with mucous gland cells. The cytology of these cells has been studied employing a variety of methods: observation of isolated, living cells using phase contrast microscopy, general morphology and cytochemical properties using fixed specimens, enzymatic cytochemistry on frozen sections and fine structural features as revealed by electron microscopy.

Based on fixed animals the mucous gland cells can be classified in two groups: antero-dorsal cells with long, indistinct rod-like secretion granules and postero-ventral cells with smaller secretion granules. These granules are round or have a short, compact rod-like appearance. The antero-dorsal cells comprise a more homogeneous group than the postero-ventral cells.

Both types are intensely alcian blue positive even at pH 0.4 and strongly basophilic and metachromatic at pH 1.5. The antero-dorsal cells are basophilic even at pH 0.4. Both groups are intensely stained in the colloidal iron procedure. The antero-dorsal cells are PAS-negative. The postero-ventral cells are variable in their reaction to the PAS-method. Some cells are strongly PAS-positive, some negative and some intermediate reactive.

Using methods as methylation, methylation plus saponification, sulfation and desulfation combined in various ways with staining with alcian blue and azur A at graded pH-values, the PAS-method and colloidal iron uptake, it is concluded that the secretions of both groups contain mucopolysaccharides possessing both carboxylic groups and sulfate groups. Both types contain many free hydroxyl-groups, some of which are in vicinal position in the postero-ventral gland cell group but not so in the antero-dorsal cells.

Amino acid end- and side groups have not been demonstrated in the secretion granules, neither neutral lipid nor oxidative and hydrolytic enzymatic activity.

The fine structure of the gland cells and the secretion granules will be described and the functional significance of the secretions will be discussed.

THE ROLE OF GLYCOPROTEINS IN EGG-SHELL FORMATION OF TREMATODES AND CESTODES. J. A. Clegg, Dept. of Zoology, Australian National University, Canberra, Australia.

The egg of trematodes and pseudophyllidean cestodes consists of an ovum and a number of 'vitelline' cells, surrounded by a protein shell which is secreted by the vitelline cells. Histochemical evidence suggests that the shell protein is stabilized by a quinone tanning system involving a phenolase and a phenolic substrate.

The shell protein has recently been isolated from Schistosoma mansoni and shown to be a glycoprotein. No free phenolic substance can be extracted from the worm and it is thought that the phenolic groups of tyrosine residues in the glycoprotein act as the substrate of the phenolase. According to this view tanning occurs by the conversion of tyrosine to the quinone of Dihydroxy-phenylalanine which then forms cross-linkages with free - NH<sub>2</sub> groups on adjacent glycoprotein molecules to give a hardened and insoluble shell protein.

The region of the uterus where egg-shell formation takes place is surrounded by a cluster of unicellular glands, collectively termed Mehlis' gland. The secretion of the gland is strongly positive to the Periodic acid - Schiff reaction and other histochemical evidence suggests that it is a mucoprotein. The mucoprotein is secreted onto the vitelline cells just before they release the shell protein and is later seen inside the shell. It is not known, however, if the mucoprotein is stimulating secretion of the shell or whether it has some other effect.

Water extracts of large numbers of glands contain a mucoprotein with a high electrophoretic mobility. This mucoprotein is currently being isolated for characterization and to enable direct studies of its physiological action to be carried out.

HISTOCHEMICAL STUDIES ON THE REGENERATION OF MUCUS-PRODUCING  
CELLS IN THE INTEGUMENT OF THE GARDEN SLUG. John A. Arcadi,  
Biology Department, Whittier College, Whittier, Calif.

Portions of the integument of the garden slug, Lehmania  
poirieri, were excised and the resulting wound was allowed  
to heal. Healing times varied from 2 to 21 days in various  
groups of animals.

Using freeze-dried and freeze-substituted tissue, the  
response of the "basket" and "granular" cell glands was  
studied in relation to their stainability with Alcian Blue,  
PAS, and Toluidine Blue.

Site and mechanism of formation of the newly formed glands  
will be discussed.



THE EFFECT OF TEMPERATURE AND PHOTOPERIOD ON MUCUS SECRETION IN A SLUG, LIMAX FLAVUS. Earl Segal, Dept. Biology, Rice University, Houston, Texas.

During the course of a study on metabolic responses and weight loss in the slug, Limax flavus at temperatures below zero, it was observed that certain individuals secreted a thick, bright yellow mucus while others secreted a thin, colorless mucus. A preliminary analysis has shown that both the previous thermal history and the photoperiod influence the secretory activity of the animals in response to the stress of prolonged subzero temperatures.

Thirty-six animals were randomly selected from a stock culture (20°C., LD 11:13), half were placed at 20°C., LD 8:16 (short day) and half were placed at 20°C., LD 16:8 (long day). After two weeks both groups were placed at -4°C. for 24 hours. Fairly uniformly the short day animals secreted an abundance of thick, bright yellow mucus while the long day animals secreted a limited amount of thin, colorless mucus. Much of the weight loss (31%, short day; 12%, long day) can be attributed to the mucus. It is of interest that 83% of the short day group died within 3 days of the cold exposure but only 17% of the long day group died.

A second group of 24 animals were moved from stock to 5°C. for two weeks. Half were under short day and half under long day photoperiod. The response to -4°C. was similar in the two groups. The majority of the animals secreted a thin, pale yellow mucus. The weight loss was 29.5% (long day) and 27.5% (short day) and only one animal of each group died within 3 days. Thus the photoperiod effect on mucus secretion was masked at a low acclimation temperature. Whether the mucus cells in the mantle and foot epithelium show morphological and/or functional changes correlated with the temperature and photoperiod is being investigated.

MUCUS OF THE GIANT SLUG, ARIOLIMAX COLUMBIANUS (GOULD).  
 Robert E. Taylor, Cystic Fibrosis Research Laboratory,  
Albert Einstein Medical Center, Philadelphia 41, Penna. \*

An extensive search for an ideal organism in which many of the general aspects of mucus secretion can be studied culminated in the selection of the giant West Coast slug, Ariolimax columbianus. Conditions suitable for keeping the slugs alive during transportation from the West to the East Coast, and for maintaining them in the laboratory for long periods were established. The specimens used repeatedly served as test subjects and as sources of exceptionally large quantities of mucus, and in other ways proved to be well-suited for experimental work. Those not misused were still apparently normal after twenty months.

Extrusion of mucus from the integumental glands was induced by touch, electrical shock, visible and ultraviolet irradiation, solutions containing monovalent (but not divalent) cations, and vapors of ammonia, acetic (but not hydrochloric) acid, acetic anhydride, diethyl ether, chloroform, ethanol, and acetone. Ammonia, or a mixture of acetic anhydride and ether vapors, were the two stimulants which elicited extrusion of the largest quantity of mucus without permanent injury to the organism.

Between 5% and 10% of the crude mucus obtained by induced extrusion consisted of solids. After removal of cellular and miscellaneous debris by centrifugation and of low molecular weight solutes by dialysis, up to 85% of this solid material remained. This fraction was indistinguishable from native mucus in many of its physical and chemical properties. It consisted of protein, polysaccharide, and inorganic ions. The inorganic residue included more than 95% of the calcium ions present in the crude mucus. Ultracentrifugal, electrophoretic, and solubility data indicate that these components constituted a single macromolecular compound. This conjugated protein was precipitated by high concentrations of ethanol, acetone, and ammonium sulfate, but not by heat, trichloroacetic or hydrochloric acid. It was isoelectric at about pH 3, and dissociated under conditions which favored removal of the bound calcium. Dissociation yielded an acidic, water-insoluble protein, and a water-soluble polysaccharide. The polysaccharide consisted of glucosamine and fucose in approximately equimolar quantities, and made up about 40% of the macromolecular complex.

The results of the chemical and physicochemical investigation of this material are interpreted to indicate that the integumental mucus obtained from Ariolimax columbianus under these conditions was primarily a single molecular species of mucoprotein in which the protein and polysaccharide moieties were joined through ionic linkages involving calcium.

\*Present address. This work has been done at the Dept. of Biol. Sciences, University of Delaware.

A COMPARATIVE STUDY OF THE INTEGUMENTARY MUCOUS CELLS OF  
 OPHIUROIDS. A.R. Fontaine, Dept. of Biology, Victoria College,  
Victoria, British Columbia, Canada.

The ophiuroid Ophiocomina nigra has been shown previously by the author to have two types of integumentary mucous gland cells: (1) a massive gland originating deep in the dermis, with a polynuclear secretory source, secreting a highly sulphated acid mucopolysaccharide, and functioning in defense against predation; (2) a unicellular gland restricted to the epidermis, secreting a simple acid mucopolysaccharide, and functioning in a suspension-feeding mechanism and sanitation. Nine other ophiuroid species have been examined for the presence of integumentary mucous cells: (Ophiocomidae) Ophiocoma scolopendrina, Ophiopteris papillosa, Ophiopsila aranea, O. annulosa; (Ophiactidae) Ophiopholis aculeata; (Amphiuridae) Amphipholis squamata, Amphiodia occidentalis; (Ophiolepidae) Ophiura texturata; (Ophiidermatidae) Ophioderma longicauda.

Three of these (Ophiocoma scolopendrina, Ophiopteris papillosa, Ophiopholis aculeata) have glands which can be equated with the massive dermal glands and with the unicellular epidermal glands of Ophiocomina on the basis of structure and histochemistry of the secretions. Four species (Ophiopsila spp., Amphipholis squamata, Amphiodia occidentalis) have only the massive dermal gland type. In all the above species, the glands appear to be concerned with feeding-sanitation or defense, or sometimes both. Only two species (Ophiura texturata, Ophioderma longicauda) lack mucous glands generally, although a few are located in the oral regions. The latter two species are largely carnivorous.

A literature survey shows that 8 further species have been examined histologically. Five of these have cells comparable to the massive dermal glands of Ophiocomina, and one has unicellular epidermal glands as well. Three species apparently lack glands. Out of 18 ophiuroids for which there is information 13 are known to secrete mucins abundantly. The most common type of secretion is a highly sulphated acid mucopolysaccharide produced by a large gland of dermal origin. Less common is a unicellular gland secreting a more simple mucopolysaccharide. Available evidence suggests that these mucous secretions are concerned primarily with defensive and/or feeding mechanisms. It may be concluded that integumentary mucous secretions are more common in the Ophiuroidea than is generally suspected, and that they play important roles in the functional biology of the group.

MUCUS IN FEEDING MECHANISMS OF SOME CRUSTACEA. Erik Dahl, Dept. of Zoology, University of Lund, Lund, Sweden.

The part played by entangling secretions in the feeding mechanisms of Crustacea is still under debate and comparatively little is known about conditions outside the Branchiopoda.

Some Malacostraca, especially the Mysidacea, feed by two different methods, either by filtering minute particles suspended in the water by means of a maxillary pumping mechanism or by picking up large food masses with the mandibular palps and thoracic endopodites. In Hemimysis Cannon and Manton found that labral secretions are probably not involved in filter feeding. This could be confirmed for Boreomysis arctica.

On the other hand during feeding on large objects the efficiency of the appendages involved is apparently enhanced by PAS-positive secretions, probably mucopolysaccharides, produced in large quantities in the mandibular palps and also distally in the thoracopods of B. arctica and Neomysis integer.

Amphipods, which are not filterers, mostly feed on large food particles manipulated with the mouth appendages, and then large quantities of PAS-positive material are secreted from the labral and other glands into the atrium oris and adjacent areas. Hyperia galba, ecto-parasite on the jelly-fish Cyanea capillata, produces extremely large quantities of such secretions from body and appendages.

The copepod Calanus finmarchicus, which feeds exclusively by filtering, produces PAS-positive secretions from the labrum and mouth appendages which enter the filter chamber. Thus in this respect it differs from the mysids where the filter chamber contains no mucus.

THE PRESENCE OF MUCCOPOLYSACCHARIDES IN THE HEPATOPANCREAS OF THE ISOPOD ARMADILLIDIUM VULGARE. Harrison R. Steeves, III, Department of Anatomy, University of Alabama Medical Center, Birmingham.

Histochemical studies on the hepatopancreas of the Isopod Armadillidium vulgare (Latreille) indicate that the distal border of the cells composing this organ contains a high quantity of acid mucopolysaccharides. At least two types are present: (1) that which stains with Toluidine Blue-O at pH 2.8 and is hyaluronidase labile, and (2) that which does not stain with Toluidine Blue-O at pH 2.8, but which stains with Alcian Blue at p.H 2.4 and is hyaluronidase fast.

The former is most probably chondroitin A or C, while the latter is at present unidentified. It is undoubtedly an acid mucopolysaccharide as evidenced by its staining with Alcian Blue, but is relatively deficient in sulfate groups. After sulfation with p-Hydrozinobenzenesulfonic acid (PBSA), however, it stains positively with Toluidine Blue-O at pH 2.8.

This distal border of the epithelium of the hepatopancreas is most probably the area of the cell responsible for the secretion of mucins, as evidenced by the fact that those mucins found within the lumen of the hepatopancreas exhibit the same histochemical properties as the distal border.

Electron micrographs of the outer border of the cells of the hepatopancreas show it to be composed of numerous, regularly arranged microvilli, approximately 0.2 - 0.3 micron long and 0.05 micron in diameter. These microvilli greatly increase the surface area of the cells and are undoubtedly concerned with the absorptive function of the hepatopancreas. They may also serve as sites of secretion, as evidenced by minute projections on their surface, the nature of which is as yet undetermined.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

2A. MARINE ZOOLOGY

MARINE FOULING COMMUNITIES OF RHODE ISLAND. Donald J. Zinn, Department of Zoology, University of Rhode Island, Kingston, R. I., Richard D. Wood, Department of Botany, University of Rhode Island, and Harold Berkson, Scripps Institution of Oceanography, LaJolla, California, U. S. A.

During the period between 1 January 1955 and 1 March 1957 the construction, assembling, installation, and testing of a series of buoyed racks of 4-inch by 5-inch glass plate and 1-inch by 3-inch standard microscope slides at three Stations in Narragansett Bay and Block Island Sound was accomplished. At the same time that bi-weekly or monthly samplings of test plates at various levels were made, plankton collections were taken. This data together with examination of samples of the substratum and previously accumulated material on the hydrography of Rhode Island waters formed the basis for the analysis of local fouling communities.

The microbenthos of the area and the early stages of the fouling community on the plates of the sampling apparatus showed little correspondence. Macroscopic foulers occurred on the bottom and on fouling test plates in the same area, but as water depth increased, these organisms decreased both in total number and in number per unit area of test plate. Floating objects or material drifting just below the surface revealed populations resembling the communities found on test objects placed in relatively the same position.

Evidence was accumulated indicating that the time limits and sequences of appearance for the inhabitants of the slime film on newly exposed surfaces are not as precise as believed heretofore; these factors apparently vary with season and with geographic location. Nearly 100 taxa of the fauna and more than 60 representatives of the flora have been identified, indicating that an unusually large variety of plants and animals comprise fouling communities in Rhode Island waters.

Total biomass of fouling organisms, greatest at the surface and least at the bottom, was probably caused in great part by gradual decrease in filamentous algae, filamentous diatoms, colonial diatoms and solitary diatoms as distance increased vertically from the water surface.

Mytilus edulis as spat appeared at all levels at all stations during the summer months. Lower temperatures increased the time for the appearance of the first bacterial slime and the attachment of diatoms. Sequence of early attachment was slime bacteria, stalked bacteria, fungi, simple diatoms, colonial and filamentous diatoms, and small ciliates. Diatoms did not have to be present before attachment of larger organisms.

STRONTIUM SCAVENGERS IN MARINE PLANKTON: THE ACANTHARIA.  
 Bruno Schreiber, Dept. of Zoology, Parma University, Parma, Italy.

Acantharia are, perhaps, the unique animals of planktonic marine fauna with a specific accumulation power for Sr, and therefore they belong to the category of "scavengers" of a well definite sea-water component. This has been recently confirmed by SCHREIBER and CAVALCA by means of a röntgenographic analysis with Weissenberg method on the spicula of *Anphylonche elongata* which appears to be built of a single monocrystal of "celestite". Owing to the presence in sea water of radioactive-isotopes of Sr, Acantharia seem to be of the highest interest as possible accumulators of those radionuclides. Till 1959 a research plan has been carried out in order to investigate the following problems: 1) systematics and ecology of Acantharia in Thyrranian and Adriatic Seas and, more recently, also in Atlantic Ocean. 2) correlation between Sr and Acantharia content in plankton. 3) measures of radioactivity and Sr90 extraction from plankton for the determination of the "concentration factor", comparatively done in samples with and without Acantharia such as in Thyrranian and Adriatic Sea. 4) breeding assays and autoradiography of Acantharia directly isolated in the open sea. The results till now achieved a positive correlation exists between Sr amount and Acantharia percentage in plankton. Extraction and measurement of the radioactive isotopes of Sr were carried out by means of two methods of radiochemical extraction studied in such a way to facilitate the separation of short-live radionuclides. Mixed samples of a large number of tows, required for reach a minimum of 50 mgr of plankton ashes have been analyzed in 1960-61 and the obtained results show a content of  $349 \mu\mu\text{C Sr90/grSr}$  for Adriatic plankton and of  $110 \mu\mu\text{C Sr90/grSr}$  in Thyrranian plankton. If however we try to calculate the concentration factor of the plankton as a whole and we consider the amount of Sr90 in sea water and the percentage of Acantharia in the two seas, it results that the ligurian plankton has a C.F. five times greater than the adriatic one. Therefore, the starting hypothesis that the Acantharia act as Sr90 accumulators seems to be confirmed. In fact the C.F. for the two seas result as follows:

Ligurian Sea  
 $\mu\mu\text{C Sr90/gr.Sr} = 110$   
 $\mu\mu\text{C Sr90/m}^3 = 65$   
 $\% \text{ Sr in pl.ashes} = 0.62$   
 C.F. = 10,490

Adriatic Sea  
 $\mu\mu\text{C Sr90/gr.Sr} = 349$   
 $\mu\mu\text{C Sr90/m}^3 = 122$   
 $\% \text{ Sr in pl.ashes} = 0.053$   
 C.F. = 1,907

Autoradiographies of Acantharia have been done by alcohol-fixed plankton samples directly put on Ilford L4 emulsion exposed for variable time periods. In two samples collected in June 1962, individuals of *Acanthostaurus* and unidentified juvenile forms appear strongly darkened with a halo in which beta tracks are recognizable. The darkening power is evident in soft parts and in myonema, while on the contrary the spiculae of adult specimens gave negative results. The fact that not the totality of specimens are active, that the gamma spectrum of the plankton shows the presence of short lives radio-nuclides, which appear to be in particulate instead of in soluble form, and that only the soft parts and not the spiculae are darkened, lead to the conclusion that other nuclides not specified, but not Sr90 are responsible of these results. Similar funds have been obtained with *Haematococcus pluvialis* cells collected in water tanks for rain out detection.



RECENT EXPERIMENTAL EVIDENCE ON THE NUTRITIONAL VALUE OF  
PHYTOFLAGELLATE TYPES TO A CALANOID COPEPOD. David L. Urry,  
Chelsea College of Science and Technology, London, England.

The marine copepod Pseudocalanus elongatus is common in British waters, and is eaten by a number of economically important fish, notably the herring (Clupea harengus) and the whiting (Gadus merlangus). The biology of Pseudocalanus elongatus is therefore of fundamental importance, and an understanding of its nutritional requirements is desirable. Attention has been drawn by several workers to the possible importance of nanoplanktonic phytoplankton to the nutrition of copepods.

This problem has been studied under laboratory conditions by maintaining stocks of this copepod and feeding these stocks with selected unialgal cultures. Adult females have been used in these experiments.

The chrysomonad Isochrysis galbana has proved to be an ideal food for maintaining laboratory stocks, since Pseudocalanus elongatus will feed readily upon this organism, normally surviving for approximately 50 days, with a survival of more than 100 days being commonplace. This may be compared with a survival of only approximately 20 days for starved Pseudocalanus elongatus. This flagellate, therefore, of only  $4\mu$  to  $8\mu$  in size, can alone provide a suitable diet for Pseudocalanus elongatus. Experiments in which Pseudocalanus elongatus has been fed with diatoms have shown that as a source of food for the copepod they are in no way superior to Isochrysis galbana.

The green  $\mu$ -flagellates do not appear to provide a suitable diet for Pseudocalanus elongatus. When a stock is fed on phytoplanktonic Chlorophyceae the survival is identical to that of a starved stock. Examination of the faecal pellets produced show the algal cells to be little altered, and it is inferred that these algae inhibit the digestive processes of Pseudocalanus elongatus.

Survival on dinoflagellates approximates to that obtained with Isochrysis galbana, and this has been true even of Gymnodinium veneficum which has previously been shown to possess toxic properties. Control experiments, however, have shown that the only culture available in the United Kingdom of this alga has lost its toxic activity.

BIOLOGY OF SOME POGONOPHORA. A. J. Southward & E. C. Southward,  
Marine Biological Laboratory, Plymouth, England.

Pogonophora are benthonic marine invertebrates classified among the lower members of the echinoderm-chordate stem (Deuterostomia). Our present knowledge of their distribution suggests association with low temperature and a good supply of (detrital ?) food material rather than solely with great depth, since they are most abundant along the continental slopes and in the adjacent trenches. They appear to be absent from the abyssal plains but are found on the continental shelf in polar and cold temperate latitudes. The upper limiting temperature seems to be about  $10-12^{\circ}\text{C}$ ., though few species occur where the annual mean bottom temperature exceeds  $9-10^{\circ}\text{C}$ .

Our work on the ecology and distribution of Pogonophora has been carried out chiefly along the continental slope of the north-east North Atlantic. Here the animals have been found in soft deposits varying from muddy sand to soft mud, at depths from 150 to 1500 metres. Their distribution on the sea-bed seems to be extremely patchy, perhaps as a consequence of the apparent absence of pelagic or mobile stages in the life history. However, there may be some association between a great abundance of Pogonophora and an imbalance in the production cycle of plankton in the waters above, caused by upwelling, with consequent organic enrichment of the bottom deposits.

Pogonophora are of particular interest because they lack an alimentary canal, and various theories have been advanced as to their method of nutrition. Experimental work is difficult because of the ease with which the elongated animals are damaged during bottom sampling. Our studies of the living animals, still in progress, deal with various aspects of the behaviour and nutrition of the adult and young stages; chemistry of the blood and other pigments (haemoglobin is present) and epidermal secretions; temperature dependence; and effects of light.

О ВЕРТИКАЛЬНОМ И ГЕОГРАФИЧЕСКОМ РАСПРОСТРАНЕНИИ  
 POGONOPHORA . А.В. Иванов, Государственный уни-  
верситет, Ленинград, СССР.

Сведения о POGONOPHORA быстро растут (в 1950 г. - 3 вида, в 1958 г. - 28, а в 1960 г. - 44, в 1963 - около 150 видов). Погонофор открывают теперь во всех морях и часто в местах, считающихся хорошо изученными (Баренцево море, Норвежские фиорды, Атлантика близ западной Европы, Средиземное море). Вероятно, действительное количество видов не менее 1000.

Погонофоры не исключительно абиссальны, хотя большая часть видов и обитает глубже 2000 м. Ультраабиссальны 20 видов (большинство - эндемики глубоководных впадин). 25 видов живет не глубже 1000 м. На глубинах менее 300 м обитает 7 видов - формы почти исключительно арктические и антарктические.

Географическое распространение погонофор имеет следующие особенности.

Погонофоры обычны в окраинных неопресненных морях и в прибрежных районах океана, но отсутствуют на океаническом ложе вдали от континентов и больших островов; окраинные моря характеризуются каждое своей фауной погонофор; глубоководные впадины не очень удаленные от континента, имеют эндемичную фауну погонофор; род *Siboglinum* в целом распространен почти повсеместно.

Прерванным географическим распространением характеризуются роды: *Oligobrachia* (Охотское море и Атлантика), *Siboglinoides* (Индийский океан и Карибское море), *Galathealinum* (Целебесское море, восточная часть Пацифик, Арктический бассейн) и *Lamellisabella* (Охотское, Берингово моря, Японская впадина, Панамский залив, Аравийское море).

Как фильтраторы=сестонофаги *Pogonophora* наиболее обычны в местах, где имеются концентрации придонной органической взвеси. Этим объясняется отсутствие погонофор в удаленных от континентов открытых пространствах океанов.

PROPAGATION OF THE COMMON STARFISH, *ASTERIAS FORBESI*, IN LONG ISLAND SOUND DURING A TWENTY-FIVE YEAR PERIOD. Victor L. Loosanoff, U. S. Bureau of Commercial Fisheries, Tiburon, California.

Observations covered the period from 1937 to 1961 and were carried in Long Island Sound in the area extending for approximately 30 miles, from Bridgeport to New Haven, Connecticut. The stations, number of which varied from 7 to 23 in different years, were located at the depths ranging from intertidal zone to 100 feet but principally in 12, 20 and 30 feet. Since 1944, locations of 10 basic stations remained the same.

The studies were designed to determine, each year, dates of beginning of setting, daily intensity of setting, end of setting and duration of setting period. Role of several environmental factors in relation to the above-mentioned chronological events and to intensity of setting within the same year and during different years was ascertained to provide, if possible, a basis for predicting time and intensity of setting.

Beginning of setting varied in different years from the last week of June to the last week of July. In 1945, the setting began and ended within the same day, September 11. In other years, it ended between July 23 and September 28. The length of setting period varied from one day in 1945 to 90 days in 1938. The time of peaks of setting also varied greatly from year to year, ranging the first week of July to the middle of August. The heaviest setting occurred in 1938, while in 1945 regardless of a large number of adult starfish present, virtually no setting took place. As a rule, setting was heavier at the 30 foot stations than in more shallow water. Starfish larvae set even at the depth of 100 feet.

No cyclical tendency in starfish setting was established. A good relationship was found between the date setting begins and intensity of set. It showed that a set beginning early may be either poor or good, but a setting beginning late is always poor. Poor sets may end early or fairly late in the season, but good sets never end early. Poor sets tend to be short, good sets tend to be long. Sets which reach a maximum early may end early or fairly late, but sets which reach a maximum late tend to end late.

The intensity of setting may depend upon departure of sunshine from normal for the period between April 16 and July 15. Thus, a sunny spring tends to be followed by a heavier set. Furthermore, if the air temperature during July is above normal, maximum set tends to occur earlier. No other environmental variables were found to have significant relationship with intensity of starfish setting or provide the basis for predicting the date set begins or ends or the duration of setting. Finally, no relationships were found between the number of adult starfish in Long Island Sound and intensity of setting, and between the intensity of starfish and oyster setting during the same years. It is suggested that the presence or absence in the water of specific food organisms and larval diseases and predators may be primarily responsible for the survival, and, therefore, intensity of setting of larval starfish. Local minor water currents may also be important.

ULTRASTRUCTURE DE LA SECRETION CEMENTAIRE DU TUBE CHEZ SABELLARIA ALVEOLATA (L.), ANNELIDE POLYCHETE. Jean Vovelle, Lab. d'Anatomie et d'Histologie comparées, Faculté des Sciences, et Lab. de Microscopie électronique du CNRS, Paris, France.

Des cellules intracoelomiques à sécrétion protéique sphérulaire élaborent la composante principale du tube de Sabellaria. La plupart d'entre elles contient des sphérules remplies d'inclusions qui noircissent à la suite du stockage du matériel après certaines fixations, le reste, un tiers environ, contient des sphérules homogènes. Ces deux catégories cellulaires sont entremêlées, sans formes intermédiaires suggérant un passage de l'une à l'autre. En microscopie optique, la dimension des cellules, la taille des inclusions, l'aspect du noyau, sont comparables dans les deux cas, comme la répartition de l'ergastoplasme et la densité des mitochondries. Seules les imprégnations argentiques révèlent des satellites argyrophiles spécifiques des sphérules hétérogènes. Les tests histochimiques de détection des protéines et des composés phénoliques, très positifs pour les sphérules homogènes, donnent une réaction plus faible pour les sphérules hétérogènes. Ces dernières, qui offrent en propre une mé-tachromasie au Bleu de Toluidine et une recoloration du réactif de Schiff rappelant les propriétés de certains pigments mélaniques, sont colorées par le Vert Malachite.

L'étude en microscopie électronique a affirmé la dualité des cellules étudiées en écartant la présence de toute structure dans les sphérules homogènes, et confirmé l'hypothèse d'une identité de nature de l'ensemble de la matière des sphérules homogènes avec la gangue périphérique aux inclusions des sphérules hétérogènes. Ces inclusions de diverses tailles, fusiformes, finement structurées de doubles stries, ont un fort contraste aux électrons après fixation formolée, comme les mélanines. On les retrouve, libérées de leur gangue, dans le tube organique interne de l'animal, dont elles forment un élément essentiel. La richesse des deux types cellulaires en lamelles ergastoplasmiques et en mitochondries apparaît importante et comparable. Dans les deux cas, le matériel d'une sphérule nouvelle apparaît dans une vésicule dépendant d'un système golgien. Pour les sphérules hétérogènes, de petites vésicules golgiennes apportent un matériel nouveau, de sorte qu'à un noyau de substance homogène s'ajoute une substance granuleuse périphérique. Cette dernière s'enfonce en multiples inclusions et se structure progressivement pour prendre un aspect lamelleux définitif.

On peut y voir une scléroprotéine, composante du ciment organique stabilisée avant son expulsion au niveau de l'organe constructeur, tandis que la protéine homogène, de double origine, subira un "tannage" ultérieur sous l'effet des sécrétions complexes du bouclier glandulaire ventral.

ORIGINE DES NOUVEAUX MUSCLES A STRUCTURE HETERONEREIDIENNE.  
René Defretin, Institut de Zoologie, Université de Lille, Nord  
France.

Au cours des transformations musculaires liées à l'épitoque chez les Néréidiens, certains muscles parapodiaux gardent leur structure néréidienne, tandis que l'on observe l'apparition de faisceaux importants de nouveaux muscles parapodiaux ventraux antérieurs et parapodiaux dorsaux ; ils se caractérisent par un sarcoplasme abondant riche en chondriome et plastes granuleux. L'examen de Nereis se transformant au cours de l'épitoque naturelle montre que ces muscles à structure hétéronéréidienne se développent au sein d'un tissu d'aspect syncytial dont l'origine n'avait pu être précisée.

Afin d'élucider le mode de formation et la nature de ce syncytium qui n'existe pas chez les formes atokes, il a été procédé à l'examen systématique de nombreux exemplaires de Perinereis cultrifera effectuant une épitoque expérimentale. A cet effet, l'ablation de leur prostomium a été préliminairement effectuée par M. DURCHON.

Avant même toute modification morphologique des parapodes on constate, dans les régions où se formeront les nouveaux muscles hétéronéréidiens, une prolifération importante de l'appareil vasculaire. Ces petits vaisseaux, à paroi ultra-mince, se hérissent de véritables touffes de cellules hautes suivant un processus qui paraît comparable à celui de la formation des néphroéléocytes. On remarque à ce niveau une richesse inhabituelle du sang vasculaire en éléments figurés et certains hémocytes de plus grande taille sont le plus souvent accolés à la paroi. Il est difficile de préciser si de tels bouquets cellulaires ont pour origine l'endothélium formant la paroi des vaisseaux, où s'il s'agit d'ambocytes de la lymphe temporairement fixés, ou enfin s'ils proviennent de gros hémocytes ayant franchi le mince endothélium par diapédèse comme certaines figures le laissent supposer.

Sur des exemplaires plus évolués, on remarque dans les mêmes régions des formations d'allure syncytiale dans lesquelles apparaissent de fines fibrilles isolées.

Les fibres hétéronéréidiennes nouvelles se forment donc dans un tissu primitivement indifférencié dont l'origine est liée à une active prolifération de l'appareil vasculaire.

**LARVAL DEVELOPMENT OF NEREIS DIVERSICOLOR IN RELATION TO REGIONAL SALINITY.** Ralph I. Smith, Dept. of Zoology, University of California, Berkeley, Calif., U.S.A.

The larval development of Nereis diversicolor has been studied at Kristineberg Zoological Station (Swedish west coast), where surface chlorinities approximate 10-11 gm/L (salinity ca. 19 ‰) and at Tvärminne Zoological Station (Finnish south coast), where chlorinities are about 3 gm/L (salinity ca. 5.4 ‰). Fertilization is possible at both stations over a wide range of chlorinities, but there is at each locality a marked "bottleneck" of chlorinity, above and below which development is blocked in the cleavage stages. Chlorinity tolerance increases during the trochophoral stages, and widens most markedly by the stage of "three equal setigerous segments" to essentially the range of tolerance of the adult.

At Kristineberg the chlorinity bottleneck is from 5 to 15 gm/L, with an optimum for development near 10-11 gm/L (thus close to environmental chlorinity). Development at the extremes of 5 and 15 gm/L is retarded, but normal in its outcome.

In the less saline waters of the inner Baltic, near the ecological limit of the species, the bottleneck for successful early development is from chlorinities of 3 gm/L (only slightly below environmental chlorinity) to somewhat above 7.5 gm/L. The chlorinity optimum for development at Tvärminne lies near 7.5 gm/L (twice the environmental chlorinity and close to the concentration found in the regulated coelomic fluid of the parent worm).

A chlorinity of 10 gm/L, which is optimal for development at Kristineberg, is lethal to the early stages of N. diversicolor of the inner Baltic. It is not yet known whether the observed differences in larval tolerance of salinity variation are of genetic origin, or whether they have arisen as a result of ontogenetic conditioning of the parent and of the developing oöcytes, but the problem is open to experimental solution.

Because of the fact that the oöcytes of Nereis diversicolor develop within the regulated coelomic fluid of the parent, they are not exposed to the selective pressures that might be expected to lead to the production of eggs capable of developing in fresh water, hence the extension of N. diversicolor into waters of low salinity does not seem likely to lead to the invasion of fresh water by this species. However, a closely-related species, Nereis limnicola, has been able to invade and to reproduce in fresh water by the development of the viviparous habit, based upon hermaphroditism and internal self-fertilization, thus permitting its larvae to develop in the regulated "salinity" of the coelomic fluid of the parent until an osmotically resistant stage is reached. This physiologically "simple" reproductive adaptation has permitted N. limnicola to live permanently in fresh water with essentially no change in its pattern of embryonic development. The invasion of fresh water by Nereis diversicolor seems impossible on the basis of its method of external fertilization and early development.

THE PROBLEM OF "EUCALANUS ELONGATUS DANA". Bui thi Lang,  
Scripps Institution of Oceanography, University of California,  
La Jolla, California, U.S.A., and Faculty of Science,  
University of Saigon, Vietnam.

In extension of Dr. M. W. Johnson's previous study of four forms of Eucalanus elongatus Dana in the N.E. Pacific, an examination of this copepod throughout the Pacific shows a fifth form close to E. inermis, restricted to the Indonesian-Philippine oceanic waters. This provides another example of diversity in the populations of a planktonic species on the two sides of the tropical Pacific Ocean.



THE DYNAMICS OF MIXED POPULATIONS OF NATANT DECAPOD CRUSTACEA  
IN THE NORTH SEA. J.A.Allen, Dove Marine Laboratory,  
Cullercoats, Northumberland, U.K.

Seasonal and yearly fluctuations in the natant epifauna of the North Sea must have a considerable effect on the inshore fisheries, for these animals form an important part of the food of marketable fish. Since 1954, the epifauna off the Northumberland coast has been sampled, at approximately monthly intervals, over various types of bottom at depths between 20 and 100 metres. Sampling has been carried out with a  $\frac{3}{4}$ " mesh Agassiz Trawl towed for 20 minutes. Caridean shrimps, comprising some thirteen species, dominate the catches and it was clear that the best method of dealing with the samples was to analyse the biology of each species in turn before reviewing the data as a whole. Analysis of the most common species is now complete and a yearly pattern of growth, breeding, feeding and migration is apparent.

A few shrimps are non-migratory and these appear to be limited to either deep water muds or to gravel and muddy-sands where these have a cover of hydroids and ectoprocts. Spirontocaris lilljeborgi and Pandalina brevirostris occur over mud. Pandalus borealis is also present in deep water, but outside the North Sea this species probably migrates to even greater depths with increasing age. Spirontocaris spinus and Pontophilus spinosus occur where there is a covering of zoophytes. As might be expected, species from the same substrate have different feeding habits while closely related species with similar feeding habits are found on different substrates.

The last statement also holds for the migratory species. Thus closely related Crangon vulgaris and C. allmani, both of which feed on species of Nephtys, are found on adjacent substrata with very little overlap of the populations. During the summer both migrate but in opposite directions, C. vulgaris into shallow water and C. allmani into deep water. The latter species is not competing for food with the other deep water carideans. In the case of P. borealis and P. montagui the relationship is more complex and the distributions of the two species overlap. P. montagui feeds mainly on tubiculous polychaets such as Pectinaria and does not compete with the planktotrophic P. borealis. Very few larvae of P. montagui from the mixed population in deep water survive and it is highly probable that they are eaten by P. borealis. Recruitment of the deep water population of P. montagui is by migration of older shrimps from shallow water, with the result that the population inshore is predominantly 0-group shrimps and that offshore is predominantly 1- and 2-group shrimps.

Migration can either be related to temperature and food seeking (C. vulgaris) or age (P. montagui). In the case of C. vulgaris and C. allmani there is a regular annual onshore-offshore migration, but older specimens of P. montagui never return to shallow water. When differences in breeding times and number of broods in each year are taken into account, the result obtained is a highly integrated annual pattern of species relationships.

STUDIES ON THE DECAPOD CRUSTACEA COMMENSAL WITH BRANCHING CORALS OF QUEENSLAND, AUSTRALIA. Wendell K. Patton, Dept. of Zoology, Ohio Wesleyan University, Delaware, Ohio.

In 1957 and 1958, decapod Crustacea were collected from the living portions of 141 colonies of branching coral belonging to Acropora in the family Acroporidae and Pocillopora, Seriatopora and Stylophora in the Pocilloporidae, at six Queensland localities. Of the 31 species which were collected from at least five coral colonies, 28 were felt to be obligate commensals, and these showed a marked specificity for a given family of coral, with only a single species occurring on both families. Six genera were restricted to one family or the other. Pocillopora, Seriatopora and Stylophora shared several commensal species but showed specific differences for others.

At the four localities inside the Great Parrier Reef, Heron Island, Wistari Reef, Restoration Rock and Pet Reef, the commensal relationships were as outlined above, and quite uniform. At Willis Island, 250 miles east of the Barrier Reef, the species composition was somewhat different, but the main relationships remained the same. In Moreton Bay to the south of the reef, only Acropora was present and in this locality it contained several commensal decapods that elsewhere occurred only on the Pocilloporidae.

The commensal fauna showed a fairly regular arrangement of species within the coral colony. The peripheral branches were inhabited by species of shrimp, some of which were modified for a commensal existence, while others were relatively unmodified. These species regularly occurred in groups of several mature individuals. The spaces at the base of the colony were occupied by crabs and by considerably modified shrimp. The majority of members of this group usually occurred in pairs (one male and one female per colony). The species which occur in strict pairs apparently prevent others of their species from settling on the colony. As more or less strict pairing severely limits the size of the population which a species can develop, this may well permit more than one species to occupy a given niche.

From stomach analysis and structure of the first legs, it is probable that at least some species of commensal decapods feed on silt-containing mucus shed by the corals. (Supported by a Fulbright Scholarship at the University of Queensland, Brisbane, Australia.)

DISTRIBUTION OF PINK SHRIMP LARVAE (PENAEUS DUORARUM  
BURKENROAD) IN SOUTH FLORIDA. Albert C. Jones, Inst. of  
Marine Science, University of Miami, Miami, Florida, U.S.A.

The distribution of pink shrimp larvae (Penaeus duorarum Burkenroad) on the southern Florida Shelf, Gulf of Mexico, was studied to determine their dispersion from an area of spawning. Variations in numbers of larvae exhibited in space and time were evaluated by an analysis of variance model with a factorial arrangement of the variables (month of collection, geographical area, and age of the larvae).

The numbers of larvae in time were related to the annual temperature cycle. The numbers increased rapidly with rising temperature in spring, fluctuated about a high level in summer, decreased with falling temperature in autumn, and fluctuated about a low level in winter.

Larvae were unequally distributed in the geographical area of study. Young larval stages were found primarily in areas with water depths from about 8 to 26 fathoms. They seldom were found nearer than 40 miles from the mainland. Older larval stages were found in areas with water depths ranging from 1 to 70 fathoms. Older larvae dispersed predominantly from the spawning area in a shoreward direction towards coastal estuaries, which serve as nursery areas for juvenile shrimp.

The resultant water currents appear to be of insufficient magnitude to transport larvae to the coastal estuaries. The movement might be accomplished by the larvae moving only with the flood stream of tidal currents. Evidence is presented that the larvae exhibit such behavior by the time they reach the estuaries.

OBSERVATIONS ON THE HISTOLOGY OF THE EYES OF EUPHAUSIID CRUSTACEANS. Elizabeth M. Kampa, Brian P. Boden, University of California, Scripps Institution of Oceanography, La Jolla, California and Bernard C. Abbott, University of Illinois.

The gross anatomy of the eyes of euphausiids varies so greatly from genus to genus and from species to species within a genus that it has been used frequently as a taxonomic criterion. In some species the eye is well-developed; in others it is much reduced, representing either a rudiment or a vestige of higher organization. In some of the seventeen genera the eye is spherical; in others it is bilobed, and in the latter the degree of separation of the lobes varies. In only one genus is a photophore absent from the eye.

The microanatomy of these eyes also differs greatly. In the spherical eyes organization of the ommatidia is around a single curved photoreceptive surface. In bilobed eyes two such photosensitive areas are present, usually set in different planes. The two lobes of the bilobed eye are distinctly different histologically. One lobe, usually the lower, is multidirectional and scans a wide solid angle, as does the spherical eye. The second lobe is unidirectional with long parallel ommatidia. The lobes are well separated from each other by layers of screening pigments, and, when a photophore is present, it too is isolated.

In genera with bilobed eyes the number of ommatidia in the upper lobe is usually smaller than that in the lower lobe during the larval stages when the animals live near the surface. Genera with adults having small numbers of ommatidia in the upper lobe of a bilobed eye are most often shallow-living forms throughout their life cycles.

Genera with equally numerous ommatidia in both lobes are found most often in deeper waters or undertake extensive diurnal vertical migrations.

The distribution of round-eyed euphausiids with depth is less readily generalized.

Photomicrographs of sections from the eyes of a number of euphausiids will be shown.

## A COMPARATIVE STUDY OF ARCTIC AND ANTARCTIC PYCNOGONIDA

*Joel W. Hedgpeth**Pacific Marine Station, Dillon Beach, California*

Several species of pycnogonids are abundant in arctic and antarctic waters, but neither systematic nor ecological parallels are very close, and bipolarity in any sense does not exist. Most striking is the occurrence of very large species in antarctic waters, some of them with extra pairs of legs, while at the same time there is an abundant representation of very small, possibly stenotopic species not encountered in arctic waters. With the exception of the large and ubiquitous genus *Nymphon*, the generic representation is different for the two regions. These differences may indicate an older, more evolved fauna in antarctic waters, associated with a possibly more stable and marine environment than that of the arctic regions.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

2B. MARINE ZOOLOGY

THE REPRODUCTIVE CYCLE OF THE ANTARCTIC ASTEROID, ODONTASTER  
VALIDUS KOEHLER. J. S. Pearse, Department of Biological  
Sciences, Stanford University, Stanford, California.

During 1961 the common antarctic asteroid, Odontaster validus Koehler, was studied to critically analyse the reproduction of a marine invertebrate living in an unusually low and constant sea temperature. O. validus, an omnivorous scavenger observed to feed on meat (seal, penguin, fish, and beef in traps), seal feces, small gastropods, annelids, crustacea, and diatoms and other algae, occurs circumpolar on the antarctic continental shelf and north to South Georgia Island. Samples were taken with traps and dip nets approximately every three weeks from McMurdo Sound (sea temperature = c.  $-1.9$  to  $-1.7^{\circ}\text{C}$ .) at McMurdo Station, and except from June to August, 13 miles north at Cape Evans. One sample was also taken in October 400 miles north at Hallett Station.

Histological analysis showed that initiation of oögenesis occurred during August through about February. Ova required about 18 months to mature. Consequently, two age groups of ova were always present in the gonads and three age groups were present in gonads during August and September. Spawning as indicated by a continuous decrease in gonad size (relative to animal size) occurred from May to September. Fertilization of laboratory spawned or dissected out ova was also achieved during June to September.

The timing of initiation of oögenesis and ova growth was the same in both Cape Evans and McMurdo Station samples. However, nearly all Cape Evans animals had relative gonad sizes over twice as large as comparable McMurdo Station animals. The greater amount of gametes produced by animals at Cape Evans was probably due to their feeding on a richer summer plant growth since:  
1) The sea was ice free in the summer, permitting more light penetration, three to four times longer at Cape Evans than at McMurdo Station. 2) Pyloric caeca of Cape Evans animals showed marked summer growth while pyloric caeca of McMurdo Station animals did not. 3) Cape Evans animals were much redder in color (from carotinoids?) than McMurdo Station animals. Consequently, food, quantitatively, effects the amount of gametes produced by O. validus, but probably not the timing of gametogenesis.

Neither the beginning of summer phytoplankton production, nor the slight summer increase of sea temperature and associated slight salinity decrease occurred in McMurdo Sound until late November. These factors then probably cannot be considered as effective in timing O. validus gametogenic initiation. Sunrise occurred at McMurdo Sound in mid August and appears to be the only major environmental factor to correlate with the beginning of gametogenic initiation. However, ovaries of the October sample from Hallett Station (sunrise occurred in late July) were similar to comparable McMurdo Sound samples. This makes doubtful even the possibility that seasonal light changes control the rhythmic gametogenic periods of O. validus.

Supported by the Office of Antarctic Operations, NSF- G13209, G18021, and G23210.

LA MORPHOLOGIE DES PIÈCES BUCCALES CHEZ LES  
SPLANCHNOTROPHIDAE (COPEPODES PARASITES DE MOLLUSQUES)

par Lucien LAUBIER

Le genre Splanchnotrophus a été créé par HANCOCK & NORMAN pour recevoir deux nouvelles espèces de Copépodes parasites de Mollusques Opisthobranches, S. gracilis et S. brevipes (1863); les rapports de ce genre avec les Chondracanthidae ont été soulignés dans la publication originale: pièces buccales à peu près semblables, et mâles nains présents dans les deux cas. Depuis cette date, de nombreuses espèces nouvelles ont été décrites, mais leurs auteurs se sont rangés, en ce qui concerne la structure buccale, aux conclusions de HANCOCK & NORMAN. MONOD (1928) remarque toutefois que la maxille 1 est probablement un palpe mandibulaire. DELAMARE DEBOUTTEVILLE, tout en acceptant provisoirement les résultats des anciens auteurs, souligne la nécessité d'une étude morphologique moderne des pièces buccales de Splanchnotrophus, qui comprennent actuellement une paire de mandibules munies de palpes, une paire de maxilles 2 et une paire de maxillipèdes.

J'ai étudié deux espèces de Splanchnotrophus, S. gracilis H. & N. et S. dellechiaiei D. D., et je suis à même de donner une nouvelle description de la morphologie buccale. Une lèvre supérieure bien développée recouvre partiellement une paire de mandibules tridentées de forme très originale par rapport à celles des Chondracanthidae, et dépourvues de palpes; il n'existe pas de maxille 1; les maxilles 2 styloformes portent une petite épine sub-distale; une lèvre inférieure à pilosité développée porte deux lobes latéro-antérieurs qui, passant sous les maxilles 2, viennent se développer entre elles et la base des mandibules; ces lobes latéraux sont également recouverts d'une fine pilosité. HANCOCK & NORMAN avaient décrit les lobes labiaux latéraux comme des maxilles 1, et le labium lui-même comme deux maxillipèdes accolés. Cette structure buccale est très originale au sein des Chondracanthidae; la famille des Splanchnotrophidae, qui renfermait Briarella Bergh et Ismaila Bergh, doit être réduite au seul genre Splanchnotrophus et à son sous-genre Iomanotocola, dont la validité est d'ailleurs douteuse.

Laboratoire Arago  
Banyuls-sur-Mer (P.-O.)  
France



POPULATION STUDIES ON A TROPICAL ASCIDIAN. Ivan Goodbody,  
Dept. of Zoology, University of the West Indies, Kingston,  
Jamaica.

*Ascidia nigra* (Savigny) is a primary coloniser in the inshore sessile community in Jamaica. The population breeds throughout the year but has a maximum of reproductive activity from September through December. Populations of ascidians settling on clean panels become readily visible when 3 to 4 weeks old; such populations usually reach maximum numbers 2 to 3 months after immersion of a panel and have completely died out after 24 to 30 months. Mortality rate is low during the second to eighteenth months of life and rises rapidly thereafter.

A comparison of five different populations settling at different times of the year indicates that there are insufficient differences in their survival patterns to suggest that maxima of breeding activity are linked to differences in the survival rate of the adult population. The breeding maxima may be linked instead to differences in survival of young populations during their first 4 to 6 weeks of life. Populations in this age group can be studied by rearing larvae in the laboratory, allowing them to settle on roughened glass slides and then rearing them in the sea where natural sessile communities develop in association with them. Initial studies on such populations indicate considerable variability in survival rate but the data are not yet complete.

Causes of death in the first three weeks of life are predation by flatworms, annelids and protozoa, overgrowth by colonial ascidians and possibly starvation. Older populations do not appear to suffer from predation and losses are usually incurred by sloughing of portions of the sessile community due to instability, or by actual death in situ. Of 292 losses closely studied over a period of seven months 48% are known to have died in situ.

THE EFFECT OF TEMPERATURE ON THE INCUBATION TIME,  
DEVELOPMENT AND GROWTH OF PACIFIC SARDINE  
(SARDINOPS CAERULEA GIRARD) AND NORTHERN ANCHOVY  
(ENGRAULIS MORDAX GIRARD) EMBRYOS AND LARVAE.  
Reuben Lasker, U. S. Bureau of Commercial Fisheries Biological  
Laboratory, La Jolla, California.

Time-temperature relationships for incubation time, increase in length, development of uniformly pigmented eyes and a functional jaw were determined for Pacific sardine and Northern anchovy embryos and larvae. Incubation time decreases with increasing temperature from 140 hours at 11°C to 34 hours at 21°C in the Pacific sardine. Eye pigmentation was not completed and a functional jaw failed to appear in this species below 13°C but appeared normally in the anchovy. The anchovy's incubation times and developmental rates are faster at all temperatures than the sardine but the differences between the two species diminish as the temperature increases (one day at 11°C and a few hours at 21°C.) In unfed yolk-sac sardine larvae, maximum growth is attained at 16 and 17°C before shrinking takes place due to body tissue resorption.

Incubation times deduced from field studies show that these studies compare closely with experimentally determined values.

SYSTEMATICS AND ECOLOGY OF INDO-PACIFIC FISHES  
RECENTLY ESTABLISHED IN THE EASTERN MEDITERRA-  
NEAN. Adam Ben-Tuvia, Sea Fisheries Research Station,  
Haifa, Israel.

23 Indo-Pacific fishes, belonging to 20 families, have been collected from the Mediterranean coast of Israel. It seems that all of them, with the exception of the euryhaline Aphanius dispar, immigrated through the Suez Canal. They were identified as Aprionodon brevirostris, Himantura uarnak, Etrumeus teres, Dussumieria acuta, Saurida undosquamis, Hemiramphus far, Holocentrum rubrum, Dollfusichthys sinus-arabici, Hepsetia pinguis, Sphyræna chrysotaenia, Caranx djeddaba, Apogon nigripinnis, Istiophorus gladius, Leiognathus klunzingeri, Upeneus moluccensis, Upeneus sp., Siganus rivulatus, Siganus luridus, Callionymus filamentosus, Platycephalus indicus, Stephanolepis diaspros and Lagocephalus lunaris.

Most of the species are confined to the shallow coastal waters; some of them, however, descend to a depth of 80 m. 13 species are typically demersal, four sublittoral, four inshore-pelagic and one pelagic. Many of the Indo-Pacific species are among the most common fishes found in the eastern Mediterranean and several are exploited commercially.

Difference in temperature and salinity of the Red Sea, Suez Canal and the eastern Mediterranean are discussed. The recent decrease in the salinity of the Bitter Lakes is taken into consideration as a factor in facilitating the immigration of fishes into the Mediterranean.

Dussumieria acuta, Upeneus moluccensis and Sphyræna chrysotaenia spawn in the Mediterranean from July to September while in the southern Red Sea their gonads were found to be ripe during the fall and winter months.

VISUAL AXIS AND ACCOMMODATION OF FISH EYES. Tamotsu Tamura,  
Lab. of Fisheries, Faculty of Agriculture, Nagoya University,  
Anzjo, Aiti-Prefecture, Japan.

Information from the literature correlated with the accommodation of fish eyes suggests that fish eyes are myopic in the resting state, and that accommodation to distant objects is accomplished by retraction of the lens toward the retina.

However, in the live fish, when kept immovable, the lens was found to be in a backward position (emmetropic or hypermetropic state). In the dead fish, the lens was found to be in a forward position, i. e. in the myopic state. Whether fishes, in their natural habitat, are myopic, emmetropic or hypermetropic in the true resting state is a problem to be investigated. A lens of an eye, just removed from the live fish, was found to be also in a forward position, and when the eye was stimulated electrically the lens was clearly seen to retract.

A superimposition of photographs of the lens taken before and after the reaction, shows the direction and range of its movement. In the Sparidae, the retraction of the lens is directed toward the dorso-temporal portion of the retina upon which is thrown an image of an object in the lower-frontal (ventro-nasal) visual field. In such fishes as Seriola lalandi (amberjack), Istiophorus albicans (sailfish), Coryphaena hippurus (dolphin), Plectorhynchus cinctus, Epinephelus septemfasciatus, Girella punctata and Therapon oxyrhynchus, the retraction of the lens is directed toward the temporal (caudal) portion of the retina which is impressed by an image from the frontal (nasal) visual field. In such fishes as Parathunnus atlanticus (black-finned tuna), Katsuwonus pelamis (oceanic skipjack) and Sarda sarda (bonito), the retraction is directed toward the ventro-temporal portion of the retina which is impressed by an image from the upper-frontal (dorso-nasal) visual field.

As the lens was found to move almost always toward the retinal region of highest cone density, a characteristic direction of visual axis for each species was established. The ecological significance of different visual axes is quite obvious when one considers the feeding behavior of the various fish that have been examined. The Sparidae, which have a lower-frontal visual axis, are generally classed as bottom feeders, the fishes which have an upper-frontal visual axis probably attack a prey that moves ahead and above them.

The lens of the electrically stimulated eye of Cyprinus carpio showed no movement. The retractor lentis (campanula Halleri) of this fish was found to be very feeble, a result that agrees with that of Verrier (1948). But, contrary to her findings, the mechanism of accommodation due to the contraction of fibers in the ciliary body, which exist in most vertebrates, could not be found by the author.

DIVING OF CYCLOCOCCOLITHUS FRAGILIS (LOHM.).  
ITS CONSEQUENCES FOR LIFE CYCLE IN WARM SEAS.  
Francis Bernard, Institut Océanographique,  
Jetée Nord, Alger, Algeria.

In good conditions, the Cyclococcolithus of the group fragilis divides by palmelloid cells. They remain grouped in red masses, coloured by promelanins. From bathyscaphe, such small masses can be seen at various depths.

Those masses begin to be seen to the naked eye when they reach 16 layers of cells: they are in form of a dish or a biscuit, their thickness is between 160 and 200 microns, with 5 000 to 48 000 cells. The larger masses, from 50 000 to 900 000 cells, are rarer in the sea; their growing probably needs 45 to 60 days of favourable conditions that are not often realized, according to meteorological changes.

Because of their high density (probably above 1,23), those red particles rapidly fall to the bottom. With a large tube for sedimentology we have measured their diving speed, which is between 4 to 260 m/hour. With an inverted microscope the diving of the first stages (1 to 64 stages) has been valuated: they fall from 3 to 36 mm/minute, the maximum being about 60 meters per day.

If the diving of those small stages has no practical value, the diving of the larger masses, falling from the surface to the aphotic zone in 1 or 2 days, is very interesting for the life-cycle in warm-seas. In fact, from +9 to +30°C C. fragilis swarms at all depths: the results of the Meteor cruise and our own results near Algeria, Libya, Morocco and Senegal show that this Flagellate represents at least 85% of the volume of phytoplankton in unlighted area, 60% of the same volume near surface.

Autotrophic in euphotic layers, C. fragilis is able to elaborate vitamins and carries them to great depths by the diving of the large red masses. Very temporary estimations, based on the abundance of red masses in surface near Algiers and on their speed of formation (30 to 50 days) show that zooplankton receives enough vitamins during a year.

The measurement of diving speeds changes our ideas on the life-cycles. Such a dense Calcareous Flagellate is able to cross thousand meters depth without putrefaction and to carry there factors of growth.

TRANSPORT OF NUTRIENTS IN ECHINODERMS. A. Farmanfarmanian,  
Pahlavi University, Shiraz, Iran.

Translocation of nutrients from the digestive tract to the other organs of the echinoderms has been a matter of controversy for over a half a century. The reasons for this controversy are:

1. The fluids in the water vascular system and the hemal system are not accessible to proper sampling and analysis.

2. The plasma phase of the perivisceral fluid is usually very low in organic content. Hence it is argued that digested material is not transported via this fluid in a dissolved state to any significant degree.

3. Several investigators have reported that the digestive tract of some holothuroids is only permeable to water. The conclusion implied is that digested material is carried to the various tissues via means other than passive diffusion or "active transport" across the gut wall.

4. Coelomocytes found in the perivisceral fluid have been generally observed in all the other tissues of these animals. Some of these corpuscles are phagocytic and are known to ingest a variety of particles. Therefore it is proposed that food is translocated by these coelomocytes.

Recently the problem has been reexamined with the aid of modern tools such as radioactive tracers, chromatography, and microchemical analyses. These investigations were carried out using Strongylocentrotus purpuratus, Leptosynapta inhaerens, and Holothuria tubulosa at Berkeley, Woods Hole, and Naples respectively. The results conclusively showed that materials fed to these organisms appear largely in the plasma phase of the perivisceral fluid and are carried to the various organs via this fluid. The water vascular system and the hemal sinuses are not significantly involved in nutrient transport. Evidence indicated that sugars may cross the gut wall by "active transport" and that cellular transport of digested food may be involved under some circumstances.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

3A. PARASITOLOGY

## A CILIATE PROTOZOAN OF WHALE LICE

J. L. Mohr, H. Matsudo, and Y. M. Leung  
(Dept. of Biology, Univ. of Southern California, Los Angeles, Calif.)

W. T. Calman (pers. comm.) observed a chonotrich on a Greenland narwhal cyamid (whale-louse). Similar chonotrichs, sometimes with suckers, occur on cyamids infesting whales heavily, as those on hump-backed or gray whales. They are stylochonids (exclusively marine, collar not spiral) with collar border simple (versus bilobed in Lobochona, spined in Kentrochona rayed in Heliochona), and body section cylindrical (versus compressed in Kentrochona and in Stylochona nebalina). The body is attached to the host by a stalk varying in length in different species. Budding occurs in a marsupium which is deeper than that of Trichochona.

Individuals are more numerous on young hosts (other genera of chonotrichs are more numerous on old hosts.) There is no site specificity except that they do not occur on host gills. Other chonotrichs (except the anomalous Stylochona sivertseni) occur at points on their hosts where there are streams of food particles, a fact related to weak mouth ciliation (small food vortex). Whale-louse feeding may make food particles available over a wider area. Some individuals contain algae like those growing on them and their neighbors.

Occurrence of the chonotrich on the baleen copepod, Balaenophilus (called to our attention by D. W. Rice) is of great interest because other chonotrichs are found on crustaceans with brood pouches or on those retaining the young for some time.

The genus occurs in North Atlantic, South Pacific, and eastern and western North Pacific Oceans and Chukchi Sea. Only Lobochona among chonotrichs has a similarly extended distribution.



CILIATE PROTOZOA AS INQUILINES OF THE ECHINOIDEA. Jacques Berger, Department of Zoology, University of Illinois, Urbana, Illinois, U.S.A.

Fifty-two species of obligate endozoic ciliates have been reported from the gut of echinoids, their sole habitat within these hosts. Of these, 32 belong to the HYMENOSTOMATIDA; the remaining forms represent the TRICHOSTOMATIDA (9 spp.), PERITRICHIDA (4 spp.), HETEROTRICHIDA (4 spp.), OLIGOTRICHIDA (1 sp.), and the HYPOTRICHIDA (2 spp.). These ciliates are commensal with their hosts; most forms derive their nourishment from intestinal microflora and/or macerated algae ingested by their hosts. Six species are facultative carnivores. Two trichostomes are obligate predators whose diet consists solely of smaller inquilinic ciliates. An adaptation to this niche is the assumption of a flattened body shape by larger species. No evidence of "parasitic degeneration" exists. Little host-specificity enters into this association; the mean number of host species supporting a given ciliate species is 5, with a range of 1-22. However, biometric data confirm the presence of xenodemes within most ciliate species.

Of the 62 echinoids examined to date, 42 of 49 "regular" species are hosts, while only 2 of 7 clypeasteroid and 1 of 6 spatangoid forms are infaunated. This is probably due to differences in their diets; the regular and clypeasteroid hosts browse on algae and encrusting organisms, whereas unsuitable "irregular" echinoids ingest a substrate which is presumably non-utilizable as food by ciliates. The mean number of ciliate species inhabiting an echinoid species is 7, with a range of 1-26.

Zoogeographical data demonstrate that these ciliates are grouped into distinct circumboreal and pansubtropical assemblages within the Northern Hemisphere. They each contain unique and closely related species. Some endemism exists within each group in the Pacific Ocean. Such data imply that by virtue of their more conservative evolutionary rates, inquilinic ciliates may clarify their host's phylogeny; e.g. the degree of similarity of intestinal faunules among allopatric congeneric hosts may be correlated with the recency of speciation of the latter from an ancestral population. Bathymetric data indicate that a host species may contain quantitatively and qualitatively different faunules at various depths within its range.

No cystic stages are known for these inquilinic ciliates and ex situ survival is poor. Transmission is presumably effected by host ingestion of trophic forms along with fecal material. This must be an efficient mechanism as suitable hosts are characteristically infaunated throughout their ranges. Sexuality is known for certain hymenostome species. Most species exhibit "fission blooms" interspersed with extended periods of cytokinetic dormancy.

DEUX NOUVELLES OPALINES DE L'OUEST AFRICAÏN. Charles BOISSON, Lab. de Zoologie, Faculté des Sciences, Dakar - SENEGAL.

Nous présentons les caractères marquants de deux Opalines africaines. Nous estimons qu'il s'agit d'espèces nouvelles.

1°) une Opaline, hôte du batracien Ptychadena pumilio BOU-LANGER, que l'on rencontre fréquemment aux environs de Dakar. Les caractéristiques de cette Cepedea sont : corps en amande ; la largeur égale les  $\frac{2}{3}$  de la longueur, celle-ci varie de 200 à 300  $\mu$  ; l'opaline est légèrement voussée sur les deux faces, l'épaisseur varie de 10  $\mu$  vers l'avant à 40  $\mu$  vers l'arrière. Les lignes de flagelles sont dans le sens de la plus grande dimension, elles sont espacées au maximum de 5  $\mu$ . Les flagelles sont courts : 5 à 6  $\mu$ . Les noyaux nombreux, ronds, très visibles après coloration sont assez variables de taille : 5 à 8  $\mu$  de diamètre. Nous proposons de ranger cette opaline, à cause de sa forme notablement bombée en amande, dans le genre Cepedea et de l'appeler : Cepedea amygdala, sp. n.

2°) une Opaline, hôte du batracien Hyla senegalensis commun aux environs de Dakar. Il s'agit d'une Cepedea longue de 340 à 700  $\mu$  et large ou épaisse de 25 à 45  $\mu$ . Le corps est uni et de section transversale ronde ou elliptique chez les jeunes sujets. Il est marqué d'arrêtes ou de plis longitudinaux qui chevauchent et semblent s'enlacer chez les formes adultes, la section transversale devient alors polygonale et irrégulière. Les noyaux nombreux mesurent 9 à 11  $\mu$  de diamètre. Ils sont peu visibles sur l'opaline entière mais bien visible sur les coupes après coloration. La ciliature, très dense, abonde particulièrement à la partie terminale autour du cytoprocte. Les cils ou flagelles sont longs, ils atteignent 12  $\mu$ . La présence des plis et arrêtes est un critère de l'âge de l'opaline mais non un critère d'espèce. Nous proposons pour cette belle Cepedea l'appellation : Cepedea crispa, sp. n.

DURABILITY OF ENTAMOEBA INVADENS IN AXENIC SERIAL CULTURES.  
Norman R. Stoll, The Rockefeller Institute, New York 21,  
New York.

One of the advantages of growing Entamoeba invadens axenically has been the opportunity to employ long intervals between subcultures in maintaining individual strains, and lines within strains. This is shown by successful transfers made from durable cultures more than 6 months old that have not been previously entered. Thus in one line each of Strains B & C in 5 years there were respectively 16 and 17 serial transfers. Five of the subculture intervals in Strain B, and 4 in C, have been of 7 to 9 months.

Some cultures retain organisms capable of subinoculation after much longer periods, as illustrated in lines from another strain, A, that have been separated 6-1/2 years. In one of these, line "d", with 16 serial transfers, the 12th was from a culture tube inoculated 57 months previously; in another line, "j", with only 6 serial transfers in the 6-1/2 years, the 6th was from a culture made 5-1/2 years earlier. Without special prearrangement, two lines derived from "d" have in turn independently spanned 4 years with only 3 transfers each: "dc" at successive intervals of 27, 14, and 8 months; "dg" at 17, 23, and 10 months.

Durability of cultures extends the range of usefulness of E. invadens as a biological reagent. The axenic medium preferred has been autoclaved liver broth, supplemented with RLE (raw liver extract) and mucin, and used without antibiotics. The cultures, vaseline sealed, are held at 22°C. Entamoebas remain active throughout the life of a culture, and no cysts have been observed. The strains (for which I am indebted to Eugene Meerovitch) were originally isolated from infected reptiles. They were received as Miller-type cultures (serum-saline-liver tissue), and subsequently axenized.

SOME FACETS OF HOST-PARASITE-DRUG INTERACTIONS IN AMEBIC INFECTIONS. Brahma S. Kaushiva, University of Libya, Tripoli, Libya.

The purpose of the study is to indicate the present status relative to the effects of chemotherapeutants, physiologic factors involved, and metabolic patterns concerned in intestinal amebic infections. A comparison of approaches and methods is proposed for imaginative understanding of biological problems such as the taxonomic status of Entamoeba histolytica, significance of the cyst, tissue invasiveness, and finally the very concept of the disease.

A large number of varied compounds have been screened against E. histolytica, E. invadens, Naegleria gruberi, Schizopyrenus russelli, Didascalus thorntoni, Hartmannella rhyssodes, H. glebae, and Acanthamoeba to reveal their biological properties and to elucidate the structure-activity-relationships (SAR). It has been shown that emetine is more active on E. histolytica than on the free-living amebas. But conessine is more active on the free-living forms than on E. histolytica. Such differential susceptibilities may have taxonomic significance. Different types of amebicidal activities have been noticed and data on comparative action of some standard and newer amebicides are presented. The need for amplification of our methods for estimating antiamebic activity is emphasized.

A consideration of enzymatic changes in the specific areas of amebic invasion may yield valuable biochemical information regarding the host-parasite relationships. Investigations undertaken on alkaline phosphatase in the host tissue revealed an alteration in the enzyme distribution ascribable to bacterial components. Although the study did not indicate the mechanism of invasion by amebas, it showed that seemingly innocuous procedures such as bacterial inoculations do produce profound changes in the biochemical pattern of mucosa. This evidence is supportive of the viewpoint that the associated bacteria are involved in contributing to the disease complex. After all, virulence in E. histolytica may not have intrinsic biochemical basis. Apparently, it is a resultant effect of bacterial ecological factors. The pertinacity of ecological and nutritional approaches for a fuller appreciation of intestinal parasitism due to E. histolytica is advocated.

DISTRIBUTION AND DEVELOPMENT OF LEISHMANIA DONOVANI LEPTOMONADS  
IN LABORATORY INFECTIONS OF PHLEBOTOMUS PAPATASI AND ITS  
APPLICATION TO KALA-AZAR TRANSMISSION IN THE SUDAN.

Donald Heyneman, International Center for Medical Research  
and Training, Hooper Foundation, University of California,  
San Francisco Medical Center, San Francisco, California.

Laboratory colonies of Phlebotomus papatasi from Cairo, UAR, and central Sudan were infected with a Sudanese strain of Leishmania donovani, using a mouseskin membrane and macerated infected hamster spleen in rabbit blood. Suspensions of LD-bodies, ranging from 1,500 to 200,000 organisms per 0.1 cu mm, produced infection levels in the sandflies that followed a similar level and course of infection after several days development despite the widely varying infective feeds. The two host strains tested followed the same pattern of parasitemia, but differed both in proportions of flies that fed and proportions that became infected.

Course of the infection showed a tendency for flagellates to move posteriorly as well as anteriorly, a phenomenon not previously observed except in massive infections, but one that helps explain the sharp downturn in intensity and percentage infection over the 15-day period of study. Observations are given of loss of leptomonads through the hindgut and death of considerable numbers of leptomonads prior to evacuation.

The sequence of infection stages based on individual fly dissections over 15 days is reported. Included is the time of emergence from spleen cells, observations on growth and exflagellation, migration, localization, size range, and approximation of leptomonad population sizes and changes over the observation period. Form of the "mature" leptomonads and function of "stout" or "division forms" are discussed.

The pattern of L. donovani infection in P. papatasi is compared with earlier observations of infection in established vectors, and with current findings of naturally infected P. orientalis obtained in the kala-azar belt of central Sudan.

TRANSFORMATION IN TRYPANOSOMA EQUIPERDUM. Yost U. Amrein,  
Dept. of Zoology, Pomona College, Claremont, California.

Few reports on nucleic acid-mediated genetic transformation among protozoa exist in the literature, and work published deals with transfer of drug resistance and pathogenicity. The present investigation reports the findings of experimental transformation between two strains of Trypanosoma equiperdum, using the kinetoplast as a marker.

An akinetoplastic strain of T. equiperdum and a normal kinetoplastic strain of the same hemoflagellate, obtained from Dr. E. Tobie, N.I.H. Bethesda, Md., were used in this investigation. While the akinetoplastic strain appears to be 100% akinetoplastic, the normal kinetoplastic (USDA) strain exhibits between 0.2 to 0.8% trypanosomes without a kinetoplast.

Nucleic acid extractions were made from citrate saline-washed akinetoplastic T. equiperdum, harvested from heavily parasitized adult laboratory rats. The methods used were essentially those described by Marmur (J. Mol. Biol. 3: 208, 1961) with slight modifications.

For transformation experiments, washed T. equiperdum, kinetoplastic strain, were suspended in glucose citrate saline in small test tubes, and a few drops of nucleic acid preparation from the akinetoplastic strain were mixed in with each tube. Experimental, as well as control tubes, were let stand at room temperature for varying lengths of time up to 24 hours. Following this, the trypanosome suspensions were injected into uninfected laboratory mice. After a proper interval of time, tail blood smears of these mice were made, stained by Giemsa's technique, and examined. At least a thousand trypanosomes were counted per slide and the percentages of kinetoplastic and akinetoplastic flagellates were recorded.

From numerous experiments run so far, using usually different batches of nucleic acid preparations, we obtained in more than a dozen instances an increase in the percentage of akinetoplastic trypanosomes. This was usually well above double the percentage of the recipient kinetoplastic strain and ran as high as 5.1%. Experiments conducted with DNase and/or heat-treated nucleic acid preparations did not yield any significant increase in the percentage of flagellates without kinetoplasts. (Supported in part by grant A1-02915-04 of the U. S. Public Health Service).

**THE REDUVIID VECTORS OF CHAGAS' DISEASE IN PANAMA.** Alan C. Pipkin,  
USN Medical Science Unit, Gorgas Memorial Lab. Panama City, Panama.

Although parasitological literature includes a few isolated reports of natural infections of Reduviid bugs with Trypanosoma cruzi in Panamá, no definitive surveys to determine the most common vectors of this infection in that area have been published. The present work, a year-long continuation of a preliminary survey made in 1961, is oriented toward a demonstration of the species of Triatominae most closely associated with human habitation in areas of Panamá where the disease is known to be endemic.

A total of 2887 specimens of Triatominae have been taken during the last year in night collections from houses and closely associated domestic animal shelters in Central Panamá. Although this total indicates the presence of a definite public health problem, it is at the same time apparent that house-frequenting species do not occur as commonly in Panamá as they do in other countries of Central America where Chagas' disease is also endemic. Virtually all (with the exception of only seven specimens, 4 Triatoma dimidiata and 3 Panstrongylus megistus) have been identified as Rhodnius pallescens Barber (1932), obviously the most common domestic species in this area.

A total of 1022, or 35.4 per cent of the bugs collected, have been found to be positive for Trypanosoma cruzi. In addition, a very few (considerably less than 1.0 per cent) have also been found to harbor T. rangeli, another trypanosome species known to be parasitic in man and animals in several Central and South American countries, although agreed to be non-pathogenic.

A breakdown of field collection data by month suggests a gradual build up of the domiciliary bug population during the rainy months of the year, particularly from July through December. There is also a significantly higher percentage (about 10 per cent on an average) of bugs found infected with T. cruzi in the rainy season as compared to the dry season. A part of the bugs taken in several collections during the last quarter were determined as to sex, and of these, the females outnumbered the males by 153 to 79, respectively. A calculation of infectivity rates by sex shows, however, that the per cent of infected females (82 of 153, or 53.6 per cent) is 12 per cent less than that of males (52 of 79, or 65.6 per cent). However, since 65.9 (153 of 232) of the bugs collected from houses during this period were females, it is apparent that they have a greater opportunity to bite human beings. Further analysis of the data reveals differences in the incidence of bugs collected in the several communities within the Central Panamá survey area, as well as small differences in the infectivity rate of bugs taken in the respective areas.

Surveys conducted further afield in other areas of Panamá have so far failed to show any appreciable infestation of houses with Reduviid bugs. Spot surveys have been made in the Darien Province in Southeastern Panamá, as well as in the Almirante and Valiente Peninsula areas of the Bocas del Toro Province of Northwestern Panamá with little success. One ecological difference which may at least partly account for this is seen in the type of houses employed in these areas. The rural population of Central Panamá builds primitive mud-walled, thatched-roof dwellings offering excellent harborage for the Reduviid bugs, whereas in the other areas mentioned above, more modern building materials are available and are frequently employed, either because of availability or through personal preference.

STRAIN VARIATION IN TRICHOMONAS VAGINALIS. Robert Samuels,  
Dept. of Microbiology, Univ. of Colorado Medical School,  
Denver, Colorado.

Antigenic variability, and differences in drug sensitivity have been investigated in nine strains of Trichomonas vaginalis.

Cross-absorption, agglutination tests of live organisms against both "natural" and immune antibodies have shown that there are antigenic differences among strains. Results of parallel tests with "natural" and immune antibodies have been mutually consistent. To find further heterogeneity, other than that of the surface antigens involved in agglutination, lysates are being assayed against immune antibodies in an agar-gel, double diffusion system.

A spectrum of drug sensitivities has been established for each strain by tube-dilution assay under standard conditions. Independent variability has been demonstrated between drug sensitivities and antigenic group in agglutination. Rates of mutation to increased drug resistance are now under study to determine whether initial resistance influences the ability to evolve to higher levels.



STUDIES ON THE HAEMATOZOA OF THE REPTILES OF WEST PAKISTAN. I, A HAEMO-  
GREGARINE FROM SNAKE ECHIS CARINATUS OF THE SIND REGION OF WEST PAKISTAN.  
Ahmed Mohiuddin, Dept. of Zoology, University of Sind, West Pakistan.

The saw-scaled viper, Echis carinatus is a fairly common snake of the Sind region of West Pakistan. In an attempt to study the blood parasites, a large number of the snakes were examined and approximately 33% of them showed a positive and in some cases heavy infection in the peripheral blood. Schizogonic stages were found in great abundance in the sections of lung, where they were lodged in the lung capillaries. Parasites were also found in the liver and heart but were scarce. The few mites, collected from these snakes, were examined but no developmental stage could be found in them.

As far as the author has been able to ascertain, there does not seem to be any record of a haemogregarine described from this host, and from this area. There are also differences of measurements as well as of certain morphological characteristics from the haemogregarines of other snakes described so far from this area, and in view of this it is considered to be a new species and is named Haemogregarina echisi.

THE COURSE OF ANTIBODY PRODUCTION IN EXPERIMENTAL *EIMERIA BOVIS* INFECTIONS IN CALVES AS DEMONSTRATED BY FLUORESCENT STAINING.\*  
Ferron L. Andersen, Datus M. Hammond, and Paul B. Carter, Agricultural Experiment Station, Utah State University, Logan, Utah.

The indirect method of fluorescent staining was used to detect humoral antibodies against the coccidium, *Eimeria bovis*, and to follow the course of antibody production in 18 experimentally infected calves. Blood samples were collected at 3 day intervals prior to the course of infection and until about 1 month following the last inoculation of oocysts. After that time bleeding was done at weekly or longer intervals for 3-4 additional months.

Merozoites of this parasite were used as antigen and were obtained by crushing fresh schizonts on clean glass slides. The smears were dried and refrigerated until time of use. A portion of each serum sample was diluted 1 to 50 with phosphate-buffered saline at pH 7.2, and allowed to react with the merozoite smears for  $\frac{1}{2}$  hr at room temperature. After the uncombined serum was thoroughly rinsed from the slides, a drop of fluorescein-labeled rabbit anti-bovine globulin was layered over the test area and again reacted for  $\frac{1}{2}$  hr at room temperature. The slides were then washed and dried, mounted with buffered glycerol, and examined immediately under a Zeiss fluorescence microscope. A ring of fluorescence around the merozoites demonstrated the presence of antibody in the test serum. Fluorescence was graded 1+ to 4+, and the last serial dilution of serum which yielded a 2+ reaction was taken as the titer.

Fluorescence of the merozoites was not observed with serum collected from any of the calves until 10 to 22 days after inoculation. In 10 calves orally inoculated with 25,000 *E. bovis* oocysts and with 1.0 million oocysts 26 or 27 days later, antibody was first detected at a mean of 14.5 days. The other mean values for this group were as follows: maximum titer, 1:250 at 28.4 days after first inoculation; titer at 118.8 days after second inoculation, 1:100.

In 8 calves orally inoculated once with 1.0 million oocysts, antibody was first detected after a mean of 14.8 days. The other mean values for this group were as follows: maximum titer, 1:462 at 22.1 days after inoculation; titer at 97.9 days after inoculation, 1:100. Thus, the average interval between inoculation and first antibody detection was similar in each group, whereas the maximum titer was significantly higher (.005 level) and occurred significantly earlier (.025 level) in the calves given one large inoculum.

---

\*Supported in part by research grant E-2374 from the Institute of Allergy and Infectious Diseases and by a fellowship (GPM-18,586) from the Division of General Medical Sciences, Public Health Service.

SYSTEMATICS, TAXONOMY, AND NOMENCLATURE OF THE TREMATODA. Horace W. Stunkard, The American Museum of Natural History, New York.

The name Trematoda was proposed by Rudolphi (1808) for the group of helminths which Zeder (1800) had designated as "Saugwürmer". The group was accorded the status of an order in the Linnaean phylum, Vermes. The first definitive classification was made by Burmeister (1856) who arranged the Trematoda in three groups: Pectobothrii, with hard, firm suckers; Malacobothrii, with soft, flexible suckers; and Aspidobothrii, with multi-loculate adhesive organs. However, Steenstrup (1842) had demonstrated alternation of generations in certain lower invertebrates and van Beneden (1858) divided the Trematoda into two groups: Monogénèses, with a single generation in the life-cycle; and Digénèses, in which a sexual generation alternates with asexual generations. The discovery of the life-history of Fasciola hepatica by Leuckart (1882) and Thomas (1883) confirmed the prescience of van Beneden.

The report by von Siebold (1849) that in Gyrodactylus there are successive generations within the embryo, and by Zeller (1876) that Polystoma integerrimum is digenetic, showed that these life-cycles violated the unity and integrity of the Monogenea and Digenea. Furthermore, Aspidogaster, which had been assigned to the Amphistomaea by Monticelli (1888), was found by Voeltzkow (1888) to be monogenetic. These aberrations led Monticelli (1892) to revert to the arrangement of Burmeister, although he renamed the suborders.

It is especially the aspidogastrids which contravene the division of the Trematoda into Monogenea and Digenea. They are primarily parasites of mollusks, but able to survive in predator hosts. Certain of them have added paratenic or transport hosts, but so far as known none of them is digenetic. Jägerskiöld (1899) discussed the anomalous situation of the aspidogastrids and Odhner (1902) showed that in general morphology they agree substantially with digenetic trematodes. Indeed, Leuckart (1879) had suggested that they are essentially progenetic rediae. Certain authors have proposed to recognize the Aspidogastrea as a group intermediate between Monogenea and Digenea, but there is no intermediate condition. The worms are monogenetic, but morphologically similar to the Digenea. Since the categories of Monticelli are merely rechristenings of the earlier ones of Burmeister, Stunkard (1962) restored the original groups of Burmeister and arranged them in conformity with morphological and developmental data. The Pectobothridia contain the monogenetic species and also Gyrodactylus and the polystomes of the Amphibia. The Malacobothridia contain two orders: Aspidobothrea Burmeister, 1856 and Digenea van Beneden, 1858. Such a disposition is logical, consistent, and in accord with all existing information.

A REVIEW OF THE ATTACHMENT MECHANISMS OF MONOGENEAN PARASITES  
J. Llewellyn, Dept. of Zoology, The University, Birmingham 15.  
UK.

Most monogenean platyhelminths are ectoparasites of the skin and gills of fishes, but others may be ecto- or endoparasitic on or in tetrapods. Since the ectoparasites live on free-swimming hosts and are highly host-specific, the development of efficient and specifically-adapted means of permanent attachment to the hosts must have been a prominent feature in the evolution of the group.

The kinds of attachment organs vary, but consist mainly of hooks, suckers, clamps, glands and miscellaneous accessory structures in various combinations, and exploit a variety of mechanical devices. A single sucker as in Leptocotyle is probably the simplest device, and in Calicotyle there is elaboration into multiple suckers, with, in addition, a pair of simple ventrally-placed anchoring hooks. In Entobdella the second pair of hooks is placed ventrally and here they act as levers to lift the roof of a large acetabulate sucker, the lift being effected through the agency of a vertically-placed pair of props formed from modified larval marginal hooks.

In polyopisthocotylines hooks are replaced ontogenetically (and probably have been replaced phylogenetically also) by new kinds of suckers that differ substantially in structure from those of Calicotyle, and which may be armed with new protrusible hooks, e.g. in Hexabothrium. In diclidophoroideans such suckers are modified into hinged clamps usually operated by extrinsic muscle--tendon--fair-lead systems, and are re-inforced by a new kind of accessory sclerite e.g. in Plectanocotyle, where the clamps grasp the free borders of the gill lamellae of the host. In Diclidophora the hinged jaws are operated not by a fair-lead but by suction-pressure generated by the movement of a diaphragm, and in Cyclocotyla the clamps have secondarily reverted to suckers, thereby emancipating parasites which previously could attach themselves only to the free borders of gill lamellae.

POPULATION STUDIES ON THE GENUS RIBEIROIA TRAVASSOS, 1939  
/TREMATODA: CATHAEMASIIDAE/. D.F. Mettrick, Dept. of  
Zoology, University of the West Indies, Kingston, Jamaica.

It is only recently that parasitologists have paid increased attention to ecological studies, and little attempt has been made to consider variations in taxonomic characters from an ecological standpoint.

Over 200 sexually mature specimens, referable to the genus Ribeiroia, were recovered from three species of fish eating birds in southern Africa, taken from five stations on a line extending approximately from latitude 11-27° South.

Morphologically when considering the three species assigned to this genus, i.e. R. insignis, Travassos, 1959, R. thomasi (McMullen, 1938) and R. congolensis Dollfus, 1950, and the new population groups collected, no group or species was found to be a distinct taxonomic unit.

Detailed statistical analysis of the variation in egg size between and within populations supports the conclusion that the genus Ribeiroia is a polytypic form as opposed to the monotypic species in the Linnaean concept of classification.

The level of variation among the populations examined increased in the following order:-

1. Between populations from the same host species in the same locality.
2. Between populations from the same host species in different localities.
3. Between a large number of specimens from the same host.
4. Between populations from different host species in the same locality.
5. Between populations from different host species in different localities.

There may therefore be a greater variation within one population than between populations from the same host species in the same or even different localities. This apparent anomaly, which suggests that a large infection derived from a common progenitor has a greater variation than smaller infections from different progenitors, is probably due to large differences in the numbers of individuals in the populations being compared.

Histograms show that the ratio of the measurements of the oral sucker to that of the measurements of the ventral sucker was the only character to show an approximately normal distribution, which throws an interesting light on the significance of this ratio which is used widely as a taxonomic character in the class.

FACTORS IN HOST RESISTANCE TO THE DWARF TAPEWORM, HYMENOLEPIS NANA. Clarence J. Weinmann, Division of Parasitology, University of California, Berkeley, California, U.S.A.

Passive transfer experiments with serum from egg infected mice provided evidence indicating that an appreciable proportion of parasites from a challenge egg exposure, compared with controls, either did not succeed in penetrating into the intestinal tissues of passively protected mice or were lost from the tissues within 12 hours. Passive protection appeared to involve inhibition of invasion rather than interference with subsequent development to cysticercoids within the intestinal villi.

Compared with normal mouse preparations, extracts of immune mouse intestinal mucosa rapidly exerted a deleterious effect in vitro upon freshly excysted cysticercoids. In comparable tests, homologous immune mouse serum was without apparent effect. In vivo experiments revealed a rapid loss of challenge cysticercoids 3 to 5 weeks after immunization by egg infection. The possible relationship between the usually short life span of this parasite and the development of acquired resistance is discussed.

Data from cross-infection experiments with Hymenolepis citelli, H. microstoma, and H. nana suggest that a tissue phase of infection is not prerequisite to the development of acquired resistance to H. nana in the direct cycle.

(This investigation was carried out in the Dept. of Biology, Rice University, Houston, Texas with support from U.S. Public Health Service Grants E-1384 and 2E-106).

PATTERNS OF PENETRATION AND DEVELOPMENT OF TWO XIPHIDIOCERCARIAE FROM THE PHILIPPINES. Carmen C. Velasquez, Dept. of Zoology, University of the Philippines, Diliman, Quezon City, Philippines.

Studies have been made on the modes of penetration and encystment of two previously undescribed xiphidiocercariae from Lymnaea (Galba) philippinensis Nevill.

The life cycle of Plagiorchis dilimanus sp. n. was established in the laboratory. Cercaria infected snails were obtained from rice paddies and ponds in Diliman, Quezon City. Metacercariae encysted in mosquito larvae and when fed to mice, gravid adults were obtained from the intestine. The early developmental stages and the adult are described.

Cercaria tanayensis sp. n. occurred in snails collected from fish-ponds in Tanay, Rizal. In the laboratory, the cercaria penetrated guppies and fry of Ophicephalus striatus Bloch. Mucoid secretions encapsulated the cercaria prior to penetration of fish. Encysted worms were obtained from muscles and nasal cavities of experimental fish. Exposure of fish to numerous cercariae proved lethal. Mouse fed with metacercariae from experimentally infected fish yielded negative results. In many instances cercariae encysted in the same snail host; when fed to a laboratory raised kitten, immature worms were recovered from the intestine after 3 days.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

3B. PARASITOLOGY



THE GOLD OF THE GOLDEN NEMATODE OF POTATOES. Conrad Ellenby,  
Department of Zoology, King's College, (University of Durham),  
Newcastle upon Tyne, Great Britain.

Some years ago I showed that the cuticle of the mature female of the golden nematode of potatoes, Heterodera rostochiensis Wollenweber (the potato root eelworm) is tanned to a resistant cyst as a result of the activity of a polyphenol oxidase. The cyst passes through a golden stage before becoming brown, but, although sectioned material shows that the cuticle itself passes through a yellow stage, the colour is too delicate and the cuticle too transparent to affect the dominant colour of the cyst; this, as is well known, is due to the appearance during the maturation of the cyst, of a yellow fluid. Tests with the fluid spotted onto paper and with frozen sections have shown that the pigment is a lipo-fuscin. Frozen sections of young white "cysts" are filled with globules of clear oil-like material. The globules change gradually to the characteristic golden colour, the process beginning, in sections, just inside the cyst wall, and spreading to the centre. Changes in pigmentation are accompanied by changes in the reactions of the material; in particular argentaffinity increases with pigmentation while affinity for Sudan dyes decreases. The presence of a fat-peroxide has been demonstrated.

The role of this material in the maturation of the cyst has not been established. Preliminary examination of the beet-cyst eelworm, H. schachtii has, as yet, failed to reveal the presence of a related compound. Since cysts of most Heterodera species do not pass through a "golden" phase, it seems hardly likely that it plays a part in the tanning of the cyst wall. However, frozen sections of untanned cuticles of potato-cysts or beet-cysts turn brown sooner than controls when incubated in buffer solution to which some of the yellow material from potato cysts has been added. Heating the mixture to boiling destroys its effectiveness, but whether this is due to the destruction of an enzyme or to the thermolability of the agent involved is not yet clear.

## PATTERNS OF SPECIFICITY FOR NEMATODE PARASITES OF INSECTS.

H.E. Welch, Entomology Research Institute for Biological Control  
Belleville, Ontario, Canada.

Nematodes of five superfamilies are known parasites of insects of at least 16 Orders. Although the data are meagre, several patterns of specificity are apparent especially for the higher levels of classification. The Rhabditoidea and the Oxyuroidea are either ectoparasitic or intestinal parasites. The former has a wider distribution than the latter, which probably arises from the greater adaptability of the Rhabditoidea in both their free-living and parasitic stages. The remaining three superfamilies are mainly endoparasites of the body cavities of their hosts. The Tylenchoidea and Aphelenchoidea are found mainly in the more advanced insects such as the Diptera, Coleoptera, and Hymenoptera. Their more complex life histories are undoubtedly products of their evolutionary adaptation to these insects. The widespread distribution of the Mermithoidea probably stems from the development of several modes of host infection.

OBSERVATIONS ON THE BLOOD-FLUKE OF MERLUCCIOUS MERLUCCIOUS, AN  
IMPORTANT FOOD FISH. Sheila Willmott, Commonwealth Bureau of  
Helminthology, The White House, 103 St. Peter's Street,  
St. Albans, Herts, England.

Approximately 800 hake from three localities off the coasts  
of the British Isles have been examined. About one third of  
these were parasitized by Aporocotyle spinosicanalis, first  
described in 1958. Some fish harboured as many as 40 flukes  
in the heart and there appears to be a pathogenic effect.

CHEMICAL ATTRACTION OF SCHISTOSOMA MANSONI MIRACIDIA. Austin J. MacInnis, Dept. of Biol. Sci., Florida State University (Present Address: Dept. of Biol., Rice University, Houston 1, Texas). \*

Observations of Schistosoma mansoni miracidia in the presence of agar blocks impregnated with short-chained fatty acids, some amino acids, and a sialic acid (N-acetyl-neuraminic acid), and unimpregnated controls, revealed responses interpreted as kineses and taxes. These responses are identical to those exhibited in the presence of a known snail host, Australorbis glabratus. They are similar to those shown by free-living flatworms in response to chemicals diffusing from food sources. Thus host-finding by free-swimming miracidia was hypothesized as being analogous to food-finding by free-living flatworms.

The miracidial responses to chemical stimuli were analyzed and classified into undirected responses (kineses) and directed responses (taxes). These responses were observed to occur up to 7 mm from the source of the stimulus, the maximum distance from the source observable in the test system. Therefore, the reactions may occur at greater distances from the source.

This knowledge of miracidial behavior permitted definition of chemical attraction of miracidia to snails as "changes in the orientation of miracidia in response to chemicals diffusing from a source, resulting in maneuvers which serve to bring the miracidia to the source and tend to keep them there."

The existence of kineses and taxes in response to chemical stimuli is considered qualitative evidence that chemical attraction of S. mansoni miracidia exists. In order to obtain quantitative evidence, the directed responses were used to record and compare the responses of miracidia to living A. glabratus, to these snails following various treatments, to agar blocks impregnated with various chemicals, and to unimpregnated control blocks. These experiments provided quantitative evidence that chemical attraction exists.

The discussion includes an analysis and classification of S. mansoni miracidial behavior in the presence and absence of chemical stimuli, and application of this knowledge to quantitative proof of chemical attraction of the miracidia to the snail.

\* This investigation was carried out during tenure of a Pre-doctoral Fellowship from the Division of General Medical Sciences, United States Public Health Service.

RELATIONSHIPS BETWEEN Heterakis gallinarum (NEMATODA) AND Histomonas meleagridis (FLAGELLATA) IN GALLINACEOUS BIRDS.  
Holger Madsen, Jagtfondens Vildtbiologiske Undersøgelser,  
Universitetsparken 15, Copenhagen, Ø., Denmark.

On a previous occasion (MADSEN (1962), Parasitology 52, 7P) reasons have been given in a preliminary way for doubting the current belief that blackhead (entero-hepatitis, typhlo-hepatitis) in gallinaceous birds is a helminth-borne disease. It is commonly assumed that Histomonas meleagridis, a caecal flagellate, is transmitted in the egg of the caecal worm, Heterakis gallinarum. However, the evidence has been in the main indirect.

Demonstration of Histomonas in the nematode egg is exceptional. Similar exceptional infections of other nematode eggs with other intestinal protozoans have been reported. It will be demonstrated in the paper that the very evidence which has been used in favour of the current view can as well be interpreted in the here proposed terms.

The varying frequencies of blackhead occurring in different groups of experimental birds, using common batches of Heterakis eggs, and the demonstration of Histomonas infections in experimental birds before their being infected with Heterakis eggs make it clear that the assumption of the helminth-borne aetiology of blackhead is superfluous.

The unquestionable association between blackhead and Heterakis gallinarum finds its explanation in the interplay between the stress imposed upon the caeca by the Heterakis larvae and the susceptibility of the bird host to blackhead.

**ONCHOCERCA VOLVULUS:** Nomenclatura, taxonomía y morfología.  
Francisco J. Aguilar, Prof. de Parasitología, Escuela de Medicina, Universidad de San Carlos, Guatemala.

Se presenta la revisión de la helmintología de la Enfermedad de Robles (Oncocercosis), con referencia detallada del descubrimiento y primeras descripciones del nematode Onchocerca volvulus; se refieren los comentarios de Dalmat a la Comisión Internacional de Nomenclatura respecto a -- errores en la escritura del nombre del parásito, así como al establecimiento de que la primera descripción fué hecha por Manson en 1892 y no por -- Leuckart en 1893, como generalmente se afirma. Se sigue el curso de las investigaciones de Prout, Brumpt, Fülleborn y Rodenwaldt, hasta llegar al año de 1915 en que Robles descubre la enfermedad en Guatemala y hace una descripción completa de los diversos aspectos de la misma. Una vez más, se insiste en que la afección debe llevar su nombre.

Con base en los datos obtenidos, se propone la siguiente nomenclatura del parásito:

Onchocerca volvulus (Manson, 1892) Railliet y Henry, 1910

Sinonimia: Filaria volvulus Manson, 1892

Onchocerca caecutiens Brumpt, 1919

En cuanto a la taxonomía, se pasa revista a las clasificaciones existentes, concluyendo en que es necesario que la Comisión Internacional dicte resolución para unificar criterios.

Se hace revisión del género Onchocerca y de las especies que comprende, comentando en forma especial los notables trabajos de Sandground y Caballero; se establece que hasta la fecha, en Guatemala, sólo se ha descrito la Onchocerca volvulus en el hombre y la Onchocerca linealis en el ganado.

En relación a la morfología del parásito, se revisa los datos ofrecidos por diversos autores, especialmente por Caballero; se presenta algunas observaciones personales y, finalmente, se hace una sinopsis de la descripción morfológica.

La transmission héréditaire des Bactéries symbiotiques chez  
les Lygaeidae vivipares (Heteroptera).

par

Jacques CARAYON

57 Rue Cuvier, Paris, France

La plupart des Hétéroptères Lygaeidae vivent en symbiose avec des Bactéries qu'ils hébergent soit dans des "mycétomes" isolés au milieu du tissu adipeux soit, plus souvent, dans des "cryptes" ou "coecums gastriques" qui sont des diverticules de l'intestin moyen.

Chez les espèces où existent de tels diverticules les Symbiontes sont généralement transmis de génération en génération par la coque des oeufs. A la période de ponte, une partie d'entre eux quittent les cryptes et passent dans la région postérieure de l'intestin, où ils se mêlent à une sécrétion visqueuse.

Les femelles en pondant enduisent le chorion des oeufs avec cette sécrétion chargée de Symbiontes, que les larves aspireront aussitôt après leur éclosion.

A la différence de tous les autres Lygaeidés connus, les Rhyparochrominae du genre Stilbocoris Bergroth sont vivipares (J. CARAYON, 1961). Chez eux, les femelles ne pondent donc pas d'oeufs, mais donnent directement naissance à des larves I, seulement enveloppées à leur sortie de l'organisme maternel par une très mince cuticule embryonnaire.

Les Stilbocoris, qui se nourrissent exclusivement de graines de Ficus, possèdent de grandes cryptes intestinales appartenant au type habituel chez les Rhyparochrominés et contenant d'innombrables Bactéries symbiotiques en forme de très courts bâtonnets. Les femelles gravides, dont l'abdomen est rempli d'embryons en fin de développement, cessent de s'alimenter. Leur tube digestif est vide ou presque, mais dans sa partie postérieure, les coupes histologiques montrent des amas d'une sécrétion enrobant de nombreux symbiontes descendus des cryptes.

Le processus de contamination, qui se prépare donc comme chez les Rhyparochrominés ovipares, se déroule ensuite tout autrement. Au lieu d'enduire le chorion des oeufs, ici absent, la femelle de Stilbocoris dépose, à côté de chacune des larves auxquelles elle donne naissance, une gouttelette translucide remplie de Bactéries symbiotiques. Les larves sortant de l'organisme maternel ont un intestin vide et des cryptes sans Symbiontes. Après s'être débarrassées de la cuticule embryonnaire, elles parcourent les alentours du point où elles ont été déposées en tatonnant le sol avec la pointe de leur rostre. Lorsqu'elles rencontrent une des gouttelettes chargées de Symbiontes, elles en aspirent longuement le contenu et se contaminent.

Il apparaît que les particularités de la transmission des Symbiontes chez ces Lygaeidés sont corrélatives de leur viviparité.

CONTRIBUTION A L'ETUDE DES PARASITES ET COMMENSAUX DE GIBBULA UMBILICALIS DA COSTA. L. Arvy, Lab. Physiologie, C.N.R.Z. Jouy-en-Josas, France.

La dissection de plus d'un millier de Gibbula récoltés dans la baie du Prieuré à Dinard (Ille-et-Vilaine) révèle que ce gastéropode prosobranch est assez fréquemment parasité par deux cercaires cotylicherques qui envahissent et détruisent la gonade ; l'une a des sporocystes blancs, l'autre des sporocystes jaunes-orangés ; l'infestation par la première est environ six fois plus fréquente que l'infestation par la deuxième ; l'infestation des gibbules peut être mixte (2 cas), la gonade contenant simultanément des sporocystes jaunes-orangés et des sporocystes blancs.

Les Gibbula umbilicalis de Roscoff (Finistère) hébergent avec la même fréquence que celles de Dinard, les deux cercaires cotylicherques. Elles contiennent, en outre, dans leur glande médio-intestinale, une cercaire cystophore, Cercaria Vaullegeardi Pelseneer, qui semble manquer à Dinard.

Les gibbules de Dinard hébergent environ 2 fois sur cent un syllidien pré-columellaire qui ne semble pas encore avoir été signalé ; comme les Gibbula cineraria de Roscoff, les Gibbula umbilicalis de Dinard hébergent dans leur rectum un Eucopépode très proche du Rhadinicola elongata Levin. (1877) parasite d'Annélides et dénommé Trochicola enterica par Dollfus (1914). Par contre, elles ne semblent pas abriter le Lichomolgus trochi trouvé à Wimereux (Canu, 1899) et à Roscoff (Boquet, 1956).



THE EVOLUTIONARY HISTORY OF A COPEPOD NOW PARASITIC IN A MOLLUSC. J. P. Harding, Department of Zoology, British Museum (Natural History), Cromwell Road, London, S.W.7., England.

Inside the pericardium of most specimens of the mussel Congeria africana from the brackish water lagoon in Nigeria are to be found one, two or three adult female copepods belonging to a new genus and species. These females do not themselves carry egg-sacs attached to their bodies, but with them in the pericardium are many detached egg-sacs, often twenty times as many egg-sacs as copepods.

The parasite is small with a very much inflated body bearing a superficial resemblance to Obesiella, another mollusc parasite. The affinities of the new genus are very interesting as it is not related to Obesiella or any other known parasite of a mollusc or other invertebrate. All copepod parasites of invertebrates known up to the present have fully marine habitats. On the contrary close examination shows clearly that it is an Ergasilid and therefore its nearest known relatives are all parasites on the gills of freshwater fishes, and it is from one of these that it must have been derived.

No males of the new copepod have been found. Presumably like the males in other Ergasilids they are free-living.

ECOLOGY OF PARASITES OF SOME PACIFIC GOBIES. Elmer R. Noble,  
Dept. of Biology, University of California, Santa Barbara;  
Goleta, California.

The parasites of eight species of fish (mostly estuarine gobies) were studied to determine whether closely related fish from similar shoreline habitats in geographically widely separated localities have any species in common or have a recognizable pattern of parasitism. The hosts collected were: Apocryptes bato at Hong Kong; Butis amboinensis at Manila; Acanthogobius flavimanus at Misaki, Japan; Bathygobius fuscus at Hong Kong and Hawaii; Istiblennius zebra at Hawaii, Oxyurichthys lonchotus at Hawaii; Limia vitatta at Hawaii; and Gillichthys mirabilis at southern California. Attention was centered on water temperature, salinity, host food; and parasites of the gills, gall bladder, liver, muscles, digestive tract and blood.

No common pattern of parasitism was observed, and few species of parasites were found to exist in more than one locality. These results differ from reports by Russian workers who compared the parasites of open sea fishes north and west of Japan with parasites of fishes in the White Sea and Barents Sea. Bathygobius fuscus at Oahu, Hawaii, in tidepools situated only 4 or 5 kilometers apart may have not only a markedly different parasite-mix but different morphological and physiological features. Fishes and their parasites in the habitats studied exhibited wide tolerances to temperature and salinity changes. Food (mostly plankton) was a major factor in parasitism. The estuarine water as a habitat for plankton varied considerably according to the source of the fresh water and extent of mixture with open seawater.

Reasons for the observed results are discussed in terms of the following bases for host specificity. 1. Probability of meeting between parasite and host. 2. Mode of parasite entrance. 3. Process of infection. 4. The environment for growth and development of the parasite. 5. Concurrent infections. 6. Time.

Generalizations concerning the "typical" parasite fauna of any species of host are hazardous to make, especially when based on collections from only one part of the host range, and without a careful study of environmental influences.

LES PARASITES DES CHIROPTERES. ROLE EPIDEMIOLOGIQUE  
CHEZ LES ANIMAUX ET L'HOMME, au KATANGA.

Michel Anciaux de Faveaux, Jadotville, Katanga.

Etude des infections et maladies provoquées, directement ou indirectement , par les Chiroptères et leurs parasites :

1. Observations écologiques sur les Chiroptères.
2. Endoparasites : bacilles, virus , parasites sanguins, protozoaires intestinaux, helminthes, acariens.
3. Ectoparasites : acariens, insectes(diptères, hémiptères, dermaptères, siphonaptères).
4. Vecteurs connus ou probables de ces parasites.
5. Histoplasmes dans les grottes du Haut-Katanga :  
dissémination possible par les Chiroptères.

THE IMMUNOLOGY OF VENOMOUS ANIMALS IN ISRAEL. Aharon Shulov,  
Dept. of Zoology, The Hebrew University of Jerusalem, Israel.

The toxicity of venoms of five species of snakes, six species of scorpions and four species of spiders was investigated. The effect of these venoms upon various animals was compared. Fresh natural venom as well as direct stings and bites was used with success in preparation of anti-sera against the Levant viper and the scorpion Leiurus quinquestriatus.

Fresh venom was found to induce production of an anti-serum more effective against fresh natural venom than could be induced by immunization with dissolved dry venom.

ГЕЛЬМИНТОФАУНЫ ПТИЦ ОТРЯДА КУРИНЫХ. Г.С. Касимов,  
Институт зоологии АН Азербайджанской ССР, СССР. (г.Баку)

1. К настоящему времени на территории земного шара у 175 видов куриных зарегистрировано 426 видов гельминтов, в том числе 200 видов нематод, 127 цестод, 88 трематод и 11 видов скребней. Из них 180 видов обнаружено в СССР.

2. В Индо-Малайской области превалируют нематоды (59%) в Палеарктической - высокий процент трематод (21%); в Эфиопской 40% цестод. При сравнении по подотрядам нематод характерен в Индо-Малайской области высокий процент оксиурат (70%) и низкий аскаридат (6,5%) и трихоцефалит (3%); в Палеарктической области - 28% оксиурат, 11% аскаридат и 13% трихоцефалит, а в Неарктической - высокий процент спирурат (42%). В Эфиопской области среди паразитов куриных нет трихоцефалит, стронгилят и филиariat.

3. В СССР число видов р. *Ascaridia*, широко распространенных на севере резко уменьшается на юге, а оксиураты отсутствующие в северной части страны богато представлены в ее южных районах.

4. Гельминтофауну куриных можно распределить на три группы: 1) гельминты, филогения которых тесно связана с куриными птицами - хозяевами этих паразитов; 2) гельминты, филогенетически связанные с птицами других отрядов и паразитирование которых у куриных птиц носит случайный характер; 3) относятся гельминты, филогения которых тесно связана с другими отрядами птиц, но отдельные виды которых давно приспособились к паразитированию у куриных.

Эволюция птиц ведет и к эволюции их гельминтов.

SOME POSSIBLE METHODS FOR THE TRANSFERRAL OF AVIAN NASAL MITES.  
Kerwin E. Hyland, Dept. of Zoology, University of Rhode Island,  
Kingston, Rhode Island, U.S.A. and Lee E. TerBush, Dept. of Zool-  
ogy, University of Rhode Island, Kingston, Rhode Island, U.S.A.

The families Breynetiidae, Rhinonyssidae and Turbinoptidae, inhabit the nasal passages of birds and nearly all orders are infested with one or more species of these mites. Methods for their transferral have not been described, but various postulates have been advanced, based mostly on circumstantial evidence.

Breynethids of the subfamily Speleognathinae are located deep in the cavity. They are densely clothed with setae, do not wet readily, and move swiftly. They appear capable of leaving the cavity at any stage. Transmission might be accomplished while the birds are drinking, mating, or in the nest. The mite, floating on the surface of the water, could be picked up on the beak or body of the bird.

Rhinonyssids live generally in the mid-portion of the cavity which is covered by mucous membrane and highly vascularized. They are large, lightly sclerotized, slow-moving, and are frequently found immersed in mucus. Most hypotheses on the transferral of rhinonyssids propose that they are transmitted from adult bird to nestlings. This idea has support because mites have been found in young house sparrows. In other birds and with other rhinonyssids this method may vary. We have found that in herring gulls these birds harboring mites were, with one exception, all four months old or older.

Turbinoptids live generally in the anterior portion of the cavity and appear less tenacious than rhinonyssids in their host association. They could be passed from one bird to another while nesting, feeding, drinking, or mating.

The method for the transmission of avian nasal mites may be one common to all families and to all birds, but this seems unlikely. It must be remembered that we are dealing with an ecological group of wide taxonomic and evolutionary diversity.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

4. VERTEBRATE ZOOLOGY

THE ORIGIN OF THE VERTEBRATE HEAD. Sydney Smith, Department of Zoology, Cambridge University, Cambridge. England.

If it is assumed that sequences of inductions observed during morphogenesis of present day vertebrates were effective in the development of the earliest vertebrates, the Ostracoderm head shield becomes more consonant with the Ammocoete than is currently assumed, the Tunicate tadpole can be reappraised and a plausible vertebrate ancestor suggested.

The vertebrate head is the product of two primary inductors: the spinocaudal, and the prechordal plate. At the margin of the primary induction there develops the neural crest from the segmental elements of which the dorsal root ganglia of the cranial nerves and of their serially corresponding splanchnic arches derive (these crest masses need the influence of the branchial endoderm to develop as cartilages). Experiment shows that notochord and mesoblast do not permit the induction from competent epiblast of massive neural material. Under similar conditions prechordal plate induces fore-brain masses with eye-cups and noses. The head may be considered to develop from the tip of the notochord in both forward and backward directions.

Some conclusions reached are:

1. that the Ostracoderm mouth is in the same place as that of the Ammocoete, and the first gill arch is mandibular,
2. that craniate vertebrates originated with the development of a prechordal plate induction system with the consequent elaboration of paired eyes and noses,
3. that the notochord-somite induction system preceded the origin of craniate vertebrates,
4. that the Tunicate tadpole with brain vesicle and sense organs anterior to the chorda is an aberrant version of an ancestor with a functional prechordal plate.



A NEW METHOD FOR THE DETERMINATION OF THE TOTAL VOLUME OF BLOOD VESSELS IN VARIOUS TISSUES AND ORGANS.

Henryk Szarski, Dept. of General Zoology, Copernicus University, Toruń, Poland.

The quantitative vascular anatomy studied in this laboratory for several years is based on procedures either very laborious, or unprecise. An improved method has been recently developed by J. Czopek and W. Błaszynski; an account will be published in full elsewhere.

Blood vessels are injected with a solution of cupric ferrocyanide, obtained by mixing watery solutions of cuprous chloride with potassium ferrocyanide. The precipitate is washed several times with distilled water, undergoes peptisation and forms a very stable colloidal solution of an intense red-brown colour. It is therefore easy to control the completeness of injection with binocular microscope.

A fragment of the organ is weighed and digested in concentrated sulfuric acid. A sample of the solution is diluted with distilled water and the copper is determined with dithizone. A control sample of the injected solution is digested and the copper is determined in the same way.

It is now easy to calculate the total volume of the blood vessels of the organ. Assuming that the volume of capillaries is about 80 per cent of the total volume, and knowing the average diameter of capillaries it is possible to calculate the total length, or the total area of capillaries in the organ examined.

The method was applied to the study of vascularization of amphibian muscles, which had been studied before in a different way. The results are in full agreement. The differences in the vascularization of individual muscles /e.g. submental, abdominal and thigh muscles/ are very similar independently of the method used. It is planned to study with the aid of the procedure described the comparative vascularization of different organs in various vertebrates.

# ON THE STRUCTURE AND EVOLUTION OF THE ACCESSORY RESPIRATORY ORGANS OF SOME INDIAN FISHES

By

A.B. MISRA

Central Drug Research Institute, Lucknow (INDIA)

From the existing accounts of the accessory respiratory organs of the Indian fishes, one is scarcely able to obtain sufficient insight into the structural anatomy of these organs as to be able to deduce their origin and evolution. For example, the fans, respiratory membrane, sac, dendrites, labyrinthine organ, nodules etcetera, that are so frequently mentioned in the zoological literature, serve only as ad hoc labels.

This is largely due to much reliance having been placed, in the past, on dissections and sections and no attempt having been made to employ the dye injection technique.

A study of Clarias batrachus, Heteropneustes fossilis, Anabas testudineus, Trichogaster fasciatus, Ophicephalus punctatus and O. striatus, by means of dissections, sections and dye injections, has resulted in the discovery of hitherto unknown features that have yielded a clue in regard to the derivation and evolution of the accessory respiratory organs.

Evidence has become available to show that the fans, dendritic organ, sac, respiratory membrane lining of the supra-branchial chamber, labyrinthine organ, plates, nodules and other structures are all derived from modified gills and their lamellae both primary and secondary. Proof of this assertion is furnished by the pattern of vascularization of the above named structures as revealed by the dye injections and by their anatomical features available to us from the work of Munshi. Details of the new findings are given in the body of the paper and the accompanying illustrations sustain the point of view that the formative material of the gills was used for developing and perfecting the accessory respiratory organs in the fishes under report.

In Hilsa ilisha and Labeo rohita gills are borne even by the epibranchials. In the former species, the gills extend even beyond the limit of the epibranchial, on the underside of the cranium. This means that a part of the formative material of which the gills are made can extend even beyond the normal limits of the epibranchial.

The fusion of the primary gill lamellae inter se and their extension beyond the epibranchial are a pointer to what may have happened, on a larger scale, in the case of fishes endeavouring to acquire accessory respiratory organs. Since the tip of the epibranchial is potentially capable of bearing gills and since a 'mat' could be formed by the fusion of the primary and abbreviation of the secondary lamellae, it served as a convenient focal point from where the 'mat' could be unrolled, so to say, in all directions. In this way, a more extensive respiratory area, composed of the same essential elements as the gills, was obtained and the need for obtaining additional quantity of oxygen for respiration served. The relationship of the diverse structures evolved to subserve the main function has been discussed. The derivation of the skeletal core of the dendritic organ and the nodules is also indicated.

REPRODUCTIVE BEHAVIOR PATTERNS AND FUNCTIONAL ANATOMY OF SOME AMERICAN OVIPAROUS CYPRINODONT FISHES. Neal R. Foster, Dept. of Conservation, Cornell University, Ithaca, New York, U.S.A.

Phylogenetic relationships among the oviparous cyprinodonts, or killifishes (Cyprinodontidae), are obscured by convergence, divergence, geographic variation, and the lack of an adequate fossil record. Comparative ethological studies were begun in the hope of finding new information of systematic significance.

The attributes of oviparous cyprinodonts for comparative studies on reproductive behavior are their general availability, relative ease of maintenance, small size, early maturity, and frequent spawning. The species studied include Cyprinodon variegatus, Jordanella floridae, Adinia xenica, Fundulus majalis, F. similis, F. heteroclitus, F. diaphanus, F. chrysotus, F. cingulatus, Lucania parva, Lucania goodei, Leptolucania ommata and some South American, African, and Asiatic species. Field and aquarium observations and morphological studies have led to the following generalizations: The sexually mature male in almost every species of killifish has contact organs distributed on certain parts of the body and/or fins. These tiny spine-like structures are restricted to those parts which consistently come in contact with the female during courtship or spawning, and they appear to function primarily as tactile organs. Similar distributions of contact organs are seen in species reported to hybridize in nature (Fundulus heteroclitus x F. diaphanus and Lucania parva x L. goodei).

Branched epiotic processes and/or bifid supraoccipital processes on the rear of the skull occur in those North American species in which the male vocalizes during courtship while flicking his head laterally. Sound production and contacting appear to have been selected for in those forms which spawn in waters where visibility is poor. On the other hand, extreme sexual dimorphism and dichromatism characterize species which spawn where visual displays can play a predominant role in the reproductive behavior.

Study supported by NSF G-23395.

LAS ESPECIES DEL GÉNERO CYNOLEBIAS STEINDACHNER, 1876  
Raúl Vaz-Ferreira, Blanca Sierra-de-Soriano & Susana Scaglia-  
de-Paulette, Departamento de Zoología, Universidad de la  
República, Montevideo, Uruguay.

Se estudian las especies del género Cynolebias del Uruguay y países vecinos, haciendo su análisis sistemático desde los puntos de vista morfológico, estadístico y etológico, describiéndose líneas intragenéricas diferentes en el proceso de acoplamiento y penetración del suelo previo a la puesta.

Se ha ce el estudio desde estos tres puntos de vista de poblaciones de Cynolebias del Uruguay, Argentina y Brasil, redescribiéndose una parte de las especies ya conocidas y describiéndose cinco especies nuevas del Uruguay y una de la Argentina, haciéndose la discusión de la unidad del género y reagrupando sus especies de acuerdo a los resultados obtenidos mediante el análisis de sus moldes etológicos.

UN NOUVEAU TYPE DE STRUCTURE CHEZ UN CLUPEOÏDE DU BASSIN DU CONGO (TELEOSTEENS ISOSPONDYLES). Max Poll, Musée royal de l'Afrique centrale, Tervuren, Belgique.

La découverte d'un petit poisson téléostéen isospondyle dans le bassin du Congo a été faite par Mr. J.P. Gosse, Hydrobiologiste belge en 1955 mais l'intérêt de cette espèce n'a été mis en évidence que récemment.

Il s'agit d'un poisson d'aspect clupeoïde dont les caractères semblaient à première vue concorder avec ceux des petits Clupeidae que l'on trouve communément dans les eaux douces centr'africaines. Toutefois, un examen plus approfondi fait apparaître, à côté des similitudes clupeidiennes, des différences remarquables, telles que l'absence d'une serrature ventrale et celle d'os supramaxillaire (caractères néanmoins constants chez les Clupeidae). Ces faits remarquables ont été le point de départ d'une étude d'ensemble de cette remarquable espèce.

Le présent rapport est une étude comparative du clupeoïde en question avec quelques autres types de poissons téléostéens isospondyles primitifs, et notamment les divers genres de Clupeidae d'eau douce de l'Afrique, notamment des familles des Clupeidae et des Dussumeriidae. C'est surtout une étude des squelettes colorés à l'alizarine et rendus transparents dans la glycérine (exposé illustré de diapositives 24/36 mm).

Au point de vue systématique, cette espèce inconnue de Poisson isospondyle appartient évidemment à un genre inconnu, mais la désignation du groupe taxonomique supérieur au genre, auquel il convient de le rattacher, est discutable.

L'exposé est une contribution à la classification et à l'évolution des Téléostéens primitifs et des Clupeoïdes en particulier.

## THE HOMOLOGIES OF THE LABYRINTHODONT CENTRUM

A. L. Panchen, Department of Zoology,  
King's College, Newcastle upon Tyne, England.

The labyrinthodont amphibia are usually grouped together with the Anura as Apsidospondyli. This group is distinguished from the Lepospondyli on the assumption that the vertebral centra were formed by the ossification of cartilaginous arcualia and not by perichordal ossification.

It has recently been suggested by E. E. Williams, however, that the single centrum occurring in most tetrapods is a homologous structure throughout the group formed inter-segmentally by the fusion of sclerotome halves without reference to arcualia.

The vertebrae of labyrinthodonts are characterised by having two centra to each vertebra: an anterior intercentrum and a posterior pleurocentrum. The basic type is the rhachitomous vertebra in which the intercentrum is a crescentic wedge, widest ventrally, and the pleurocentrum a pair of postero-dorsal blocks. An oblique line of junction thus runs postero-ventrally from the apex of the intercentrum.

Two lines of evolution diverge from this basic condition: the temnospondyl line in which the pleurocentrum is reduced and finally disappears and the anthracosaur line, related to the ancestry of reptiles, in which the pleurocentrum becomes the main element and the intercentrum is reduced but retained. This condition persists in the earliest reptiles, and for this reason it has been assumed that the pleurocentrum is the homologue of the amniote centrum and the intercentrum that of the intervertebral disc.

This, however, gives an unsatisfactory position for the labyrinthodont myoseptum, which would be expected to pass through the rib articulations on the neural arch and intercentrum. It is therefore suggested that the whole labyrinthodont centrum is the homologue of that of amniotes and that the two evolutionary lines are characterised by a movement of the oblique junction, antero-ventrally in the case of the anthracosaurs and postero-dorsally in the case of the temnospondyls.

EGG CAPSULE STRUCTURE IN THE AMPHIBIA. Stanley N. Salthe, Dept. of Zoology, Columbia University, New York 27, New York.

The morphology of the egg capsules of 32 urodeles and 41 anurans was investigated with the aid of histochemical tests, and the following conclusions drawn.

The capsules in all species studied are acid mucopolysaccharides and contain no lipids.

Urodele eggs differ from those of anurans (except as noted below) in that the innermost mucoid capsule liquifies to form a capsular fluid within a capsular chamber. The eggs of the anurans Alytes, Discoglossus, Pipa, and Eleutherodactylus have a capsular chamber as do urodeles. The presence of this chamber is interpreted as a primitive character in amphibian eggs.

There is no detailed correlation between egg structure and environment but non-aquatic eggs tend to have thinner, though not fewer, capsules. Extreme simplification of egg structure has occurred, with few exceptions, only in aquatic eggs, and is rare in urodeles, except for Cryptobranchus.

Urodele eggs form two major groups. One, displaying a large capsular chamber prior to first cleavage, is characteristic of the Hynobiidae, Salamandridae, Sirenidae, and Necturus. The other, in which the capsular chamber is at first very small, is found in the Plethodontidae. The egg of Amphiuma is not easily placed in either group. The eggs of Hynobius and Ambystoma show an almost identical structural pattern. In the Hynobius egg there are eight capsules; other salamanders show various degrees of reduction in number of capsules. On the basis of a tentative homology, different capsules are lost in different families.

The eggs of anurans are too variable to be grouped on the basis of the present limited data. The soft inner capsule, just outside the vitelline membrane, may be homologous with the capsular fluid in urodele eggs. The species in the genetically closely related americanus group of Bufo differ markedly in egg structure. The eggs of the leptodactylid Uperoleia show affinities with those of Bufo. The eggs of the marsupial hylids show no modification to their peculiar site of development, while those of Pipa do. In Pipa the egg capsules are so modified, after sinking into the skin of the female, so as to form a lid covering the egg chamber in the skin.

The secretory patterns of the oviduct in the Amphibia have obviously undergone evolutionary changes, and may be of significance taxonomically. At present, the physiological meaning of these differences in egg structure remains obscure.

UREA LEVELS AND BLADDER WATER UTILIZATION DURING DEHYDRATION OF TOADS. Rodolfo Ruibal, Division of Life Sciences, University of California, Riverside, California.

The concentrations of bladder urine and blood during dehydration was studied in Bufo marinus and B. cognatus. Homeostatic control of the concentration of the blood during dehydration was demonstrated to be correlated with absorption of water from the bladder. The urea levels in bladder urine and blood were studied during dehydration. The total urea content of the bladder was found to change during dehydration, and was not directly correlated to degree of dehydration.



PHYLOGENETIC AND ECOLOGICAL SIGNIFICANCE OF BODY FLUID  
PARTITIONING IN AMPHIBIA. Thomas B. Thorson, Dept. of Zoology  
and Physiology, University of Nebraska, Lincoln, Nebraska.

The body fluid compartments were measured and compared in five species of Amphibia: (1) the perennibranchiate aquatic Necturus maculosus (Mudpuppy); (2) the aquatic, gill-less Cryptobranchus alleganiensis (Hellbender); (3) the aquatic, gill-less Amphiuma means tridactylum (Three-toed Congo eel); (4) the primarily aquatic anuran, Rana catesbeiana (Bullfrog); and (5) the essentially terrestrial anuran, Bufo marinus (Marine toad).

Total body water was measured by complete desiccation. Extracellular fluid was measured as sucrose space and the difference between sucrose space and total water was taken as intracellular fluid volume. Plasma volume was measured as T-1824 space and the difference between this parameter and sucrose space was accepted as interstitial fluid volume.

In all parameters, C. alleganiensis, A. means tridactylum and R. catesbeiana were in remarkably close agreement (total water, ca. 79%; intracellular, ca. 57%; extracellular, ca. 22%; plasma, ca. 3.5%; interstitial, ca. 18.5%).

Of the essentially aquatic species, only N. maculosus differed appreciably from the other three. In this relatively primitive amphibian, the total water content was greater, a condition accounted for entirely by the greater extracellular fluid volume, since the intracellular space was about the same as in the other species. The increased volume of the extracellular compartment was reflected in both of its sub-compartments, plasma and interstitial fluid. This pattern is in close agreement with that reported for a series of fresh-water Osteichthyes ranging from the primitive Chondrostei, through Holostei and the more advanced Teleostei (Thorson, Biol. Bull., 120:238-254, 1961).

B. marinus, the only terrestrial species employed, had appreciably less total body water than the aquatic species; yet the extracellular compartment was appreciably greater than that of the aquatic species (excluding N. maculosus). The "deficit" of water was entirely at the expense of the intracellular compartment. Here too, the increased volume of the extracellular compartment was reflected in both of its sub-compartments. The pattern of differences between this terrestrial amphibian and the three aquatic species is similar to that between marine and fresh-water teleosts (Thorson, l.c.) and between marine and fresh-water sharks (Thorson, Science, 138:688-690, 1962). (Supported by grant H-3134 from the U.S.P.H.S.)

DIADECTES AND THE CHELONIA. Everett C. Olson, Rosenwald Hall, University of Chicago, Chicago 37, Illinois.

The genus Diadectes from the early Permian has played an important role in various hypotheses concerning the origin of the reptiles. It has been considered as representing the general source of the Chelonia, although not itself ancestral. It has been suggested as a link between this group and the seymouriamorphs (batrachosaurs).

Less than adequate knowledge of the skull has been available in part as the result of the very spongy nature of the bone. The posterior part (half) of an excellent skull has been sectioned and has revealed the structure in great detail. For the first time the nature of the middle ear is clarified. For comparison skulls of various turtles and of Seymouria have been sectioned.

The structures of the middle ear of the Chelonia and Diadectes show less definitive resemblances than has generally thought to be the case. Many of the similarities may be the result of vague convergence related to the general features of the otic region.

Buttressing of the squamosal and quadrate in Chelonia and expansion of the parasphenoid and quadrate in Diadectes have resulted in the development of similar fossae and canals in the vicinity of the middle ear. There are many detailed differences. The possibility of relationship is not ruled out, but the evidence now seems less conclusive than heretofore.

PHOTOREGULATIVE AND INNATE FACTORS IN THE REPRODUCTIVE CYCLES  
OF AN EQUATORIAL SPARROW. Alden H. Miller, Museum of Verte-  
brate Zoology, University of California, Berkeley, California.

The equatorial populations of the Andean sparrow, Zonotrichia capensis, show innate cycles in the male, recrudescence and regression of the testis each occurring twice annually under the constant day lengths of the equator. When birds are subjected to the photoperiodism of latitude 38° N, these cycles continue with little evidence of photoregulation. Thus males may attain and sustain full reproductive capacity under winter lighting whereas congeneric north-temperate species invariably remain quiescent. Excess light may be somewhat stimulatory but reduced light is not inhibitory. A period of refractoriness to light stimulation is lacking both in adult and immature males. The culminative phase of breeding, that is nesting and ovulation, is however repressed by winter conditions of northern latitudes and, conversely, is stimulated by long days and/or increased temperatures regardless of rainfall or drought.

THE SKIN STRUCTURE IN WILD ARTIODACTYLA OF THE USSR  
 FAUNA. Wladimir Sokolov, Chair of Vertebrate Zoology,  
Moscow University, USSR.

The skin structure of *Sus scrofa*, *Moschus moschiferus*, *Cervus nippon*, *C. elaphus*, *Capreolus capreolus*, *Alces alces*, *Bison bonasus*, *Gazella subgutturosa*, *Saiga tatarica*, *Rupicapra rupicapra*, *Capra aegagrus*, *C. sibirica*, *C. caucasica*, *Ovis ammon cycloceros*, *O. a. karelini*, *O. a. musimon* were investigated in this work.

The thin epidermis of the trunk consists as a rule of the basal layer, the stratum spinosum and the stratum corneum. The stratum spinosum is thicker in summer than in winter and the stratum corneum - in winter than in summer. The latter contains many loose layers due to which the thermoinsulation increases. The pigment is absent in *O. ammon*, *G. subgutturosa* and *S. tatarica*.

The dermis and its papillary layer are much thicker in summer than in winter. There are many fat cells in the papillary layer of *M. moschiferus* which create an additional thermoinsulation.

The subcutaneous fat tissue is absent or poorly developed.

The number of sebaceous glands varies from 1 to 3 at each hair. They are more developed in summer, especially in *A. alces*.

In winter some sweat glands completely disappear while the secretory portions of others become very small.

The thermoinsulatory function of hairs is partly lost in *S. scrofa*. Therefore, the subcutaneous fat tissue is well developed in this species. It protects the body from the loss of heat and serves as a safety shock-absorber when the animal passes through thickets. There are no layers in the dermis of *S. scrofa*.

The hairs may be divided into axial and wool ones in any case. There is large air-containing medullary layer in the axial hairs of all species, except *S. scrofa*. The above peculiarity serves to produce a particular type of thermoinsulation reaching its greatest development in *M. moschiferus*. The number and size of the wool hairs are very different, being small and sparse in *M. moschiferus* and large and numerous in *Capra*. The axial hairs are shorter and the wool ones thicker and shorter in summer than in winter.

ON THE FUNCTIONAL SIGNIFICANCE OF PINNATE MUSCLES. Carl Gans, State University of New York at Buffalo and Walter J. Bock, University of Illinois, Urbana.

Recent studies in functional anatomy have again come up against the old question of the possible functional significance of penniform muscles. Most authors seem to rely upon the analysis of Pfuhl (1938, *Z. Anat. Entwicklungsg.*, 106:749-81), which stated that pinnate muscles produce increased strength (by the attachment of additional fibers to a single tendon), and simultaneously claimed that the inclined fiber direction does not produce any loss.

Structural analysis suggested that Pfuhl's argument was fallacious. The lateral deflection of the muscle fibers induces laterad vectors and a corresponding loss. The pressure induced vectors at right angles to the fiber, indicated in Pfuhl's analysis, would further reduce rather than improve effectiveness. Verification may be furnished by the experiments of Hill (1931, *Proc. R. Soc., B*, 109:267) who showed that the pinnate *M. gastrocnemius* of Hungarian *R. esculenta* developed twice the tension of a parallel-fibered *M. sartorius* of equivalent total length and heat production. Beritoff (1925, *Pflügers Arch.*, 209:763) had indicated that the fiber length of Tiflis *R. temporaria* *gastrocnemius* averaged about one third the total muscle length. Pfuhl's hypothesis, which would predict development of triple tension, is shown to be invalid, if as is likely these parameters do not vary too much between the species concerned.

Re-evaluation of the problem indicates that while pinnate muscles primarily produce increased contractile force they achieve this by providing a maximum number of muscle fiber attachment sites within a minimum lateral displacement from the central tendon. There is also some suggestion that the force of the bundle may be increased by self-stopping mechanisms that reduce the percentage shortening (i.e. the excursion) and retain the fibers in the high force (=reduced contraction) portion of the tension-excision curve. Both provisions may well reflect selection on the architectural as well as the physiological level and directly involve fiber packing. It is thus unfortunate that studies on the architecture of muscle tend to be based upon materials that have been exposed to major shrinkage and distortion due to the effects of fixatives (Goldspink, 1961, *Nature*, 129(4809:1305). Pinnate muscles have a secondary advantage in certain rare cases where contraction has to take place without a thickening of the entire muscle (separation of the two parallel sides).

Comparisons of the functional meaning of muscle changes should also take into account the several physiological (rather than gross structural) changes that affect the possible tension exerted by, and the method of energy release, of a given muscle fiber.

(Supported by N.S.F. G-21819).

A RELATIONSHIP BETWEEN THYMUS AND LYMPH NODE GROWTH IN THE HAMSTER. David Shepro, Nora Kula, and Linda Poole, Simmons College and Boston University Biological Science Center, Boston, Massachusetts.

We have found a change, with age, in the cell population in lymph nodes in normal hamsters. The most dramatic shift in the percentages of cells of various types takes place at puberty. We shall demonstrate that the physiology of the thymus affects the alterations observed in the nodes.

P<sup>32</sup> uptake studies in normal and thymectomized hamsters plus autoradiographs and cell counts of the experimental tissues will provide the data for measuring the relationship between the thymus and lymphoid tissues.

The relational aspects of this mechanism with homeostasis of the organism also will be discussed. (Supported by Grant AI 03767-03, U.S.P.H.S.)

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

5. PALEONTOLOGY

ORDOVICIAN POLYCHAETE JAW APPARATUSES FROM POLAND.  
Zofia Kielan-Jaworowska, Inst. of Paleozoology, Polish  
Acad. of Sciences, Warszawa, Zwirki i Wigury 6, Poland.

Several thousands of scolecodonts and 400 entire jaw apparatuses were obtained by dissolving the Caradocian limestones in acids. The apparatuses are assigned to the superfamily Eunicea. In recent euniceids Ehlers (1864-1868) recognized two types of apparatuses (labidognatha and prionognatha). The name ctenognatha is suggested for the jaws of recent Dorvillea Parfitt and similar fossil apparatuses, as these differ from those of the forementioned types. In all the types the jaws are mostly subconical and hollow, with a ventral opening leading to the pulp cavity. In addition to the above types, there occur in the material studied also the jaws in form of convex plates for which the name placognatha is suggested. Placognath apparatuses may consist of simple jaws - provided with one row of denticles or compound jaws - provided with 2-3 rows of denticles or with denticles and undenticulated ridges. The placognaths, known so far only from Paleozoic, seem to be the most primitive in Eunicea.

It seems that the buccal armature in early euniceids first developed as the thickenings of cuticle, which later became developed into chitinous plates, on which the folds and ridges subsequently developed. The succeeding evolution of the jaws presumably involves their transformation into denticulated cones, through the covering of a part of the pulp cavity.

In the material studied there occur intermediate forms between four main patterns of apparatuses and one can trace sometimes the transition from one type to the other. 13 genera of Caradocian apparatuses are so far recognized and the conclusion concerning the homology of particular plates in fossil and recent apparatuses are given.

The studies on fossil jaw apparatuses show that the taxonomy of scolecodonts is extremely confused, the detached jaws of single apparatus being often assigned to 8 or more different "genera", usually inadequately defined. For this reason it is impossible to observe the priority of detached jaws when describing entire apparatuses.



MOLLUSKS FROM WISCONSINAN (PLEISTOCENE) ICE-CONTACT SEDIMENTS OF THE MISSOURI COTEAU IN CENTRAL NORTH DAKOTA. Samuel J. Tuthill, North Dakota Geological Survey, Grand Forks, North Dakota, Lee Clayton, Department of Geology, University of Illinois, Champaign, Illinois, and F. D. Holland, Jr., Department of Geology, University of North Dakota, Grand Forks, North Dakota.

Geologic and paleontologic evidence indicates that numerous mesotrophic, temperate, water bodies were present while drift-covered blocks of stagnant glacier ice, emplaced during Woodfordian (late Wisconsinan, Pleistocene) time, underlay the Missouri Coteau district (approximately 50 by 300 miles in extent) in central North Dakota.

Fossil mollusks, contained in sediments deposited in contact with the stagnant ice at 40 sites, are represented by 23 species including pelecypods of the families Unionidae and Sphaeriidae and gastropods of the families Valvatidae, Hydrobiidae, Physidae, Lymnaeidae, Planorbidae, Ancyliidae, Succineidae and Pupillidae. Naiad shells have provided material for five radiocarbon dates in the Missouri Coteau district which indicate that the melting of the stagnant ice may have required 2,100 years.

The fossil mollusks, as now known, do not serve as stratigraphic indices to the late Pleistocene deposits of the region, but the species composition of fossil molluscan communities dominated by the branchiate genera Valvata and Amnicola is regarded as tentative evidence of the pre-Recent age of the Missouri Coteau sediments. The mollusks also indicate the climate of the region to have been mild and humid as early as 12,000 and as late as 8,700 radiocarbon years before the present.

FORM AND FUNCTION IN AN EARLY PALEOZOIC PROTOBRANCH BIVALVE.  
A. Lee McAlester, Peabody Museum, Yale University, New Haven,  
Connecticut, U.S.A.

The common Ordovician bivalve Tancrediopsis (formerly Ctenodonta, in part) is one of about ten early Paleozoic genera which record the initial evolutionary radiation of nuculoid protobranch Bivalvia. The details of shell morphology are unusually well-known in Tancrediopsis because species of the genus occur in large numbers in unique silicified molluscan faunas found in Middle Ordovician limestones of southern Quebec, Canada. This paper reports the results of a comparison of this Ordovician nuculoid with published studies on the morphology, function and adaptations of living nuculoid bivalves.

Tancrediopsis closely resembles living representatives of the family Nuculidae in most morphologic features including: general shell shape and form, adductor musculature, and pedal and visceral musculature. In all of these features Tancrediopsis differs sharply from the second living nuculoid family, the Nuculanidae. It resembles some living Nuculanidae, however, in showing an unseparated, "external" ligament. These comparisons indicate that ligament pattern is an unreliable index of family-level phylogenetic affinity in nuculoid bivalves, and for this reason it is suggested that the family "Ctenodontidae" be re-defined or abandoned.

Functional comparisons with living Nuculidae suggest that Tancrediopsis was adapted for life as a rapidly borrowing, infaunal bivalve which lived just below the surface of relatively soft, uncompacted sediments. It is also probable that Tancrediopsis, like living Nuculidae, fed on organic matter within the sediment by means of elongate palp extensions which were thrust into the surrounding substrate from between the ventral valve margins. As in living nuculoid genera, species of Tancrediopsis differ primarily in degree of posterior shell elongation. These differences in elongation were probably related to life in differing size grades of sediment.

The basic morphology and probably also the fundamental adaptations of nuculoid bivalves were well-established by Middle Ordovician time. This indicates that nuculoids represent an early and distinctive branching of the original bivalve stock, and confirms their treatment as a separate high-level taxon of the Class Bivalvia.

THE HYOMANDIBULAR PROBLEM IN PLACODERM FISHES. T. Stanley Westoll, Dept. of Geology, University of Newcastle upon Tyne, England.

Watson described acanthodian fishes as having a "complete" hyoid arch, no specialised suspensorial hyomandibular, and an un-reduced spiracular gill-slit the "aphethochoidean" condition. The suspensorial hyomandibular of many sharks and rays is related to the formation of a dorsal "pseudo-hyoid" arch from gill-ray materials. The hyoid and branchial arch skeleton is rarely well-preserved in fossil placoderms, but the endocranium gives indirect information. Watson interpreted placoderms as aphethochoidean. The late Devonian rhenanid placoderm Jagorina, according to Stensiö, has a suspensorial hyomandibular, a pseudo-hyoid arch, no basal or otic connections of the palatoquadrate, a spiracle, and large paired antorbital bones supporting the extensive pectoral fins. The whole is interpreted in a thoroughly batoidean manner, and Rhenanida, Stensiö suggests are ancestral to true batoids. This view conflicts with the geological distribution of true batoids, unknown before the Jurassic.

A different interpretation of Jagorina is possible. The proximal articulation of the "hyomandibular" is anterior to that of a true hyomandibular; the relations are those of the elasmobranch processus oticus internus palatoquadrati (Holmgren). This develops as a blastema (in which the spiracular cartilage(s) chondrify), extending from the palatoquadrate to the lateral commissure. The importance of this embryonic structure in elasmobranchs is probably of phylogenetic significance.

The ptyctodont placoderm, Ctenurella, has recently been shown by Ørvig to represent the ancestral stock of the Holocephali; living Holocephali have an unmodified hyoid arch, though the spiracular cleft is completely closed. The high probability is that placoderms in general were neither aphethochoidean in the full sense, nor hyostylic, but resembled Holocephali. The "antorbital cartilage" of Jagorina may be derived from the arthrodiran suborbital bone. Selachii and Holocephali are probably descended from different placoderm ancestors, but these were not hyostylic; placoderms are not true elasmobranch.

THE PAIRED FINS AND AXIAL SKELETON OF THE CROSSOPTERYGIAN FISH EUSTHENOPTERON. T. Stanley Westoll and Sheila M. Andrews, Dept. of Geology, University of Newcastle upon Tyne, England.

Eusthenopteron, as a close approach to the crossopterygian ancestors of at least the bulk of the tetrapods, has been clearly documented, particularly by Jarvik's researches on the skull. Recent preparations allow a detailed account to be given of paired fins and girdles and the post-cranial axial skeleton.

The small scapulo-coracoid has no large scapular and coracoid processes; this is so in other primitive bony fishes. The glenoid cavity, already somewhat "screw-shaped" as in primitive tetrapods, bears the "screw-shaped" head of the most proximal element in the fin-skeleton. Every important feature of the humerus of early tetrapods can be identified in this bone. It is the first of five elements forming the fin-axis, the last being very small. Each of the first four carries a preaxial radial; the first, third and fourth have strong postaxial processes, that of the first (humerus) being the entepicondylar process. The first preaxial ray (radius) was clearly a bearing-member with a considerable muscular rugosity on the ventral or plantar face. The rudiments of the tetrapod elbow-joint are already present. There is no evidence of the existence of tetrapod digits, but the whole proximal region is almost fully "tetrapod" in function. Numerous foramina in the humerus may be a relic of diazonal foramina when the axis was embedded in the body wall of ancestral forms.

Pelvic fins and girdles are less advanced towards the tetrapod type. A possible cartilaginous "sacral" attachment may be indicated by a strong lateral process on an "intercentrum".

Further details of the essentially rhachitomous vertebral column and the ribs modify Jarvik's reconstructions. The short bicipital ribs are dorsal ribs; they may have counteracted sagging of the column under load, which pleural ribs cannot -- important to a proto-tetrapod.

**ПРОБЛЕМА ПРОИСХОЖДЕНИЯ ЗАВРОПСИДНЫХ И ТЕРОПСИДНЫХ ПРЕСМЫКАЮЩИХСЯ.** Д.П. Татаринов, Палеонтологический институт АН СССР, Москва, СССР.

Сравнительно-анатомические данные свидетельствуют о глубоком расхождении двух основных стволов пресмыкающихся — завропсид и теропсид. Разделение желудочка сердца и артериального ствола, связанное с переходом от амфибийного кожно-легочного дыхания к чисто легочному, проходило у завропсид и теропсид вполне самостоятельно. Разными путями достигалось и преобразование "водной" почки земноводных в "сухопутную" почку у теропсид и завропсид. Общие предки завропсид и теропсид обладали гломерулярной почкой амфибийного типа и неразделенным желудочком сердца; их приспособленность к условиям наземной жизни оставалась невысокой. Эти гипотетические предки, видимо, сохраняли еще сильно развитое кожное дыхание и проницаемые покровы.

Слуховая косточка теропсид в некоторых отношениях стоит ближе к подвеске рыб, чем к слуховой косточке завропсид. Базисфеноид у примитивных теропсид оставался отделенным от затылочных костей неокостеневающим пространством, тогда как у типичных завропсид он тесно связан с основной затылочной костью. Эти необычайно примитивные особенности теропсид сближают их с примитивнейшими земноводными, еще сохранявшими следы "рыбьего" подразделения мозговой коробки на атмосфеноид и отикоокципитальную часть.

Сеймуриаморфы, обычно рассматриваемые в качестве ближайших предков пресмыкающихся, имеют тесные связи с завропсидами; однако сомнительно, чтобы сеймуриаморфы были предками и теропсид. Геологически теропсиды древнее завропсид и, видимо, даже сеймуриаморфов. Вероятные теропсиды известны уже из среднего карбона, а к началу перми появляются представители четырех различных отрядов теропсид. Между тем из верхнего карбона известен лишь один сеймуриаморф, а достоверные остатки настоящих завропсид появляются лишь в перми. Возможно, что предками теропсид были микрозавры, которых ошибочно относят к лепоспондильным земноводным.

Приспособление ко вполне наземной жизни шло у теропсид и завропсид самостоятельно. Древнейшие пресмыкающиеся оставались тесно связанными с водой. Примитивные сеймуриаморфы сохраняли личиночное развитие. Среди завропсид очень рано произошло обособление черепахового ствола.

ON THE COMPARATIVE ANATOMY OF THE MOLARS OF HIGHER PRIMATES. G. Vandebroek, Zoological Institute, University of Louvain, Louvain, Belgium.

A comparative study of unworm teeth of the higher Primates has shown many undescribed details of structure as well in the molars of man as in those of many other genera of Catarrhina. The difficulty of interpretation in terms of evolution of the differences existing between these molars has brought the author to a reexamination of the structure and origin of the primitive placental teeth. A large revision of the tooth structure of lower mesozoic, paleocene and recent mammals has been made and is already published. On the basis of the obtained results, new interpretations of the dental structure of higher Primates may be given.

НОВЫЕ ДАННЫЕ О ФАУНЕ НИЖНИХ ЗОН ВЕРХНЕЙ ПЕРМИ СССР. П. К. Чудинов, Палеонтологический институт Академии Наук СССР, Москва, СССР.

В последние годы на востоке Европейской части СССР найдены остатки пресмыкающихся, представляющие существенный интерес для изучения фауны и стратиграфии континентальной перми. Сюда относятся находки поздних пеликозавров — казеид (р. Пинега), капторинид (р. Вятка) и примитивных терапсид (правобережье р. Камы у г. Очер). Если первые из них интересны, главным образом, самим фактом открытия типичных элементов северо-американской фауны в верхней перми СССР, то находки у г. Очер представляют новую и богатую фауну ранних терапсид (дейноцефалов, аномонтов и горгонопсий), имеющую важнейшее значение для понимания ранних этапов развития тетрапод, которые мало известны на северо-американском и африканском континентах.

Остатки наземных позвоночных, недавно добытых в Приуралье у г. Очер, одновозрастны, так как получены из одного местонахождения при раскопках линзы песчаников. Трехлетние раскопки, захватившие площадку около 6 тыс. кв. метров, дали массу дублетного материала при общем количестве не превышающем десяти родов. Это открывает очень редкую и удачную возможность для детальной характеристики новых форм с учетом диапазона изменчивости и дает более надежные основания для сравнительной оценки как ранее известных, так и вновь выделяемых таксонов.

Фауна терапсид очерского местонахождения представлена несколькими систематическими категориями. Среди всех известных терапсид Западного Приуралья терапсиды нового семейства эотитанозухид показывают не только наиболее близкое сходство с сфенакодонтными пеликозаврами Северной Америки, но и являются наиболее примитивными среди известных терапсид. Вторая особенность этой фауны — наличие гигантских растительноядных титанозухов семейства эстеменозухид, близких джонкеридам и антеозавридам Южной Африки. В составе очерской фауны отмечены бритоподиды — обычные терапсиды Приуралья, составляющие вполне обособленную ветвь развития хищных дейноцефалов. Здесь встречены также, родственные венюковидам, примитивные аномонты, которые представляют, по видимому, более наземные адаптации в фауне очерских терапсид.

Задолго до открытия очерской фауны И. А. Ефремов подчеркивал, что фауна медистых песчаников Западного Приуралья по эволюционному уровню занимает промежуточное положение между пермскими фаунами Северной Америки и Южной Африки и тем самым имеет ключевое значение, так как стоит у истоков происхождения терапсид. Этой фауне, несмотря на примитивный облик, свойственны особенности, характерные для ранних групп терапсид, что обуславливает трудности разграничения различных групп, стоящих в эволюционном отношении недалеко от сфенакодонтных предков.

Открытие новой фауны на востоке Европейской части СССР не только заполняет существенный промежуток в восстановлении истории развития пермских пресмыкающихся, но и намечает пути дальнейшего уточнения биостратиграфических схем для широкой межконтинентальной корреляции пермских отложений.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

6. SYSTEMATICS



LES COMBINAISONS MULTIDIMENSIONNELLES DE CARACTERES ANATOMIQUES  
QUANTITATIFS. Pierre Jolicoeur, Département des Sciences bio-  
logiques, Université de Montréal, Montréal, Canada.

Grâce aux progrès récents des méthodes statistiques multidimensionnelles ("multivariate statistical analysis"), il est maintenant possible d'analyser la variation d'organismes vivants par rapport à plusieurs caractères simultanément. La meilleure façon de mettre en évidence les différences que présentent plusieurs groupes d'organismes consiste à calculer leurs fonctions discriminatoires. La nature et l'importance des diverses tendances de variation que manifestent les organismes d'un même groupe peuvent être mises à jour par la méthode des composantes principales; cette méthode permet de séparer la variation de la taille de celle de la forme et de généraliser l'équation d'allométrie dont on se sert dans la description de la croissance différentielle.

L'application des méthodes multidimensionnelles à la variation du squelette de divers vertébrés (Evolution, 13 (3): 283-299, 1959; Growth, 24 (4): 339-354, 1960; Growth, 27 (1), 1963) révèle que certaines combinaisons de caractères sont très variables, comme la taille et la robustesse, tandis que d'autres sont très constantes, comme la symétrie bilatérale. La grande constance de certaines combinaisons de caractères est probablement une adaptation à la présence de relations fonctionnelles ou écologiques rigides. La grande variabilité de certaines autres combinaisons peut indiquer soit que ces combinaisons ont peu d'importance pour la biologie générale de l'espèce soit, au contraire, qu'elles sont utilisées par l'organisme pour s'ajuster aux changements des conditions du milieu.

RELATIVE GROWTH PATTERNS AS TAXONOMIC CHARACTERS IN ARTHROPODA  
Dr. Ryuichi Matsuda, Dept. of Entomology, University of Kansas,  
Lawrence, Kansas, USA.

During the study of relative growth the following tendencies have been confirmed in varying degrees in various groups of the Arthropoda: (1) When the growth ratio or the initial growth index for a segment varies among a group of related species, the ratio or the index for other segments varies in a parallel fashion. (2) Among a group of related species, the growth patterns (growth ratio or initial growth index or both) of segments with higher growth ratios are more similar than those of the other segments with lower growth ratios. The morphogenetical basis of these phenomena is discussed in a separate paper in press. It has been found that the second tendency generally holds true when closely related species, different populations of the same species, etc., were compared. Hence, the tendency can be used as working hypotheses for the study of speciation. Among related species, the growth gradient tends to be the same or similar, probably due to the second tendency. The location of the growth center is important taxonomically at higher levels of the taxonomic units. Cases of convergence of relative growth patterns are known. The initial growth index is generally a more plastic taxonomic character. In some cases a certain relative growth pattern is well established among related species, but in certain other cases it is not. Hence the taxonomic value of relative growth patterns, as adult characters, cannot be standardized. The growth ratio of head width has been found to be very similar among related species, although, contrary to the second tendency, it is small.

DISTRIBUTION OF AMINO ACIDS AND RELATED COMPOUNDS IN ANIMALS IN RELATION TO THEIR TAXONOMY. B.R. Seshachar, K.N. Saxena, & J.R. Gandhi, Department of Zoology, Delhi University, Delhi, India.

A comparative study of the distribution of amino acids and related compounds in different animals has been undertaken in order to determine the bearing of differences in their patterns on the taxonomic relationship of the animals. Two groups of animals with which we are familiar have been studied, Protozoa and Insecta. Among the Protozoa, six species of the spirotrichous ciliate, Blepharisma, are similar as regards the presence of serine/glycine, alanine, glutamic acid, aspartic acid, cysteic acid, valine, tyrosine, leucine/isoleucine and two unidentified compounds X1 and X2. All the six species are also identical in the occurrence of citrulline and histidine in half the number of batches of each species. However, these species differ from one another in respect of certain other amino compounds according to the degree of constancy in their presence in different batches of individuals. B. japonicum, B. americanum and B. tropicum resemble one another in the constant presence of threonine and lysine, and the absence of taurine in all the batches of individuals examined. B. intermedium and B. seshachari differ from the above three species in that threonine and lysine are occasionally absent and taurine is occasionally present in a few batches. B. undulans is similar to B. intermedium and B. seshachari in the occasional presence of threonine and lysine and, it resembles the remaining three species in the constant absence of taurine. Thus, the six species of Blepharisma exhibit differences in the qualitative patterns of their free amino compounds due to differences in the degree of constancy in their occurrence even though the nutritional condition of the animals remains identical.

Among the insects, the heteropteran genera Oxycarenus, Lygaeus, Dysdercus and Aspongopus are alike in the presence of the following amino compounds in free form in their whole extracts: alanine, asparagine/lysine, aspartic acid, cysteine/cystine, citrulline, glutamic acid, leucine, proline, phenyl-alanine, threonine, tyrosine and valine. Aspongopus differs from the remaining in the absence of taurine. However, the distribution of these amino compounds in different organs of the insects varies from one genus to another. The apparent similarity among the four genera of insects in respect of the qualitative pattern of the free amino compounds in whole extracts is not reflected in the pattern of the compounds in various organs.

These observations indicate that the study of taxonomic relationship of animals on the basis of comparison of qualitative patterns of free amino compounds should take into consideration (a) the distribution of the compounds in different organs and, (b) the degree of fluctuation in the presence or absence of these compounds.

SYSTEMATICS OF SPIROSTOMUM (CLASS CILIATA). Harold E. Finley, Nathaniel Boggs, and Pearl T. Crump, Dept. of Zoology, Howard University, Washington, D.C., U.S.A.

We have modified Corliss' silver impregnation technic and adapted it for use on Spirostomum. We have obtained clear evidence that the number of ciliary meridians in S. teres, S. minus, and S. ambiguum can be used to identify the species. The average number of ciliary meridians for S. teres, S. minus, and S. ambiguum is 18, 24, and 46 respectively. The ranges and the modal intervals of ciliary meridians are shown in the histograms below.

The buccal ciliature also can be used to identify the species because it's complexity increases from S. teres to S. minus to S. ambiguum. Regarding the number of infraciliary patterns (i.e., configurations) on the dorsal wall of the buccal cavity, S. teres has one pattern only, S. minus has three patterns, and S. ambiguum has six to eight patterns. The peristomial (adoral) membranelles arise near the anterior end of each species and enter the buccal cavity on the ventral wall.

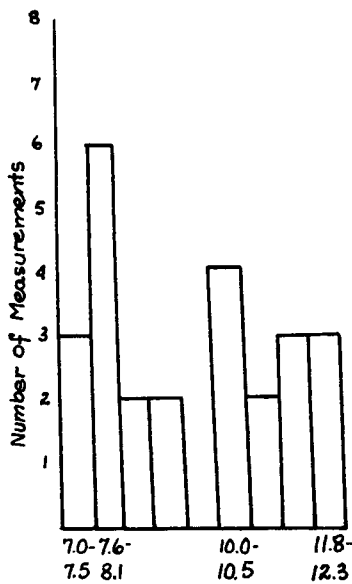


Fig. 1. The range of ciliary meridians for S. teres

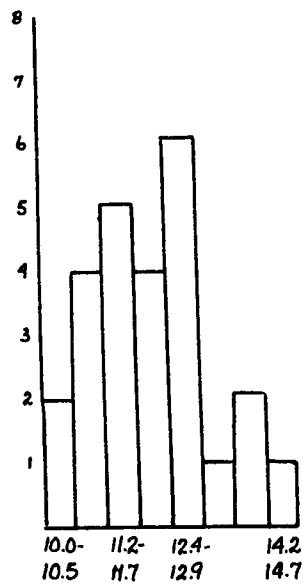


Fig. 2. The range of ciliary meridians for S. minus

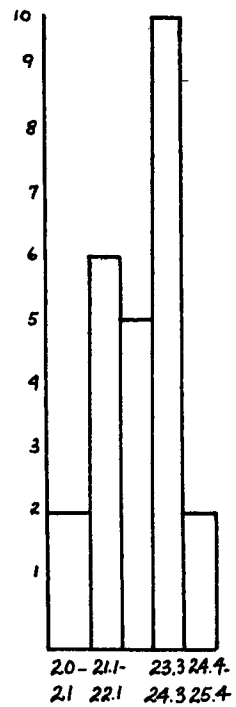


Fig. 3. The range of ciliary meridians for S. ambiguum

**VALEUR SYSTEMATIQUE DES CARACTERES MINERALOGIQUES DE LA COQUILLE  
DANS CERTAINES FAMILLES DE PROSOBRANCHES. M. Petitjean, Lab. de  
Biologie Animale PCB, Faculté des Sciences, Paris, France.**

La structure de la coquille des Gastéropodes a été peu utilisée en systématique bien qu'elle soit hautement indicatrice des affinités. Aucune étude taxonomique n'a été faite de la présence d'un cortex calcitique externe, signalée chez certains Muricidae. J'en ai étudié dans ce but environ 350 espèces au moyen de plaques minces et de spectres de Debye et Scherrer.

J'ai constaté que dans un genre sensu stricto toutes les espèces possèdent ce cortex, ou au contraire en sont dépourvues. De plus dans toutes les espèces d'un genre, ce cortex a la même importance relative par rapport à la couche aragonitique sous-jacente, soit très mince à côté d'elle ou à peu près égal à elle, soit constituant la presque totalité de l'épaisseur de la coquille. Tous les genres de la famille ont été testés de cette façon et j'ai vérifié mes constatations sur les seules espèces dont la place générique est acceptée de tous. Les résultats ont été concordants et pratiquement sans qu'il y ait d'exception pour laquelle d'autres variations aient amené des auteurs à douter de la position systématique de l'espèce considérée. La structure s'accorde alors avec la nouvelle position suggérée.

Les faits observés amènent à considérer la présence d'un cortex calcitique et son importance relative comme des caractères génériques valables, plus sûrs même que des ressemblances morphologiques qui peuvent résulter d'une simple convergence.

Ces critères permettent de distinguer Nucella, Thais et Mancinella. Les 9 espèces de Nucella étudiées ont montré un cortex calcitique qui occupe la presque totalité de l'épaisseur de la coquille. Les espèces de Thais sensu stricto ont toutes montré un cortex mince mais net. Il en a été de même des 9 espèces du S/Genre Stramonita, des 3 du S/Genre Thaisella étudiées et de Cymia tectum. Par contre les Mancinella sensu stricto ont une coquille exclusivement aragonitique. Ces trois genres ne peuvent donc absolument pas être confondus, leur répartition géographique les séparant aussi: Atlantique et Région panaméenne pour Thais, Nord de l'Atlantique et du Pacifique pour Nucella, Indo-Pacifique tropical pour Mancinella.

Je placerai donc dans des genres différents deux espèces généralement associées si l'une est à cortex calcitique alors que l'autre est entièrement aragonitique. J'ai ainsi observé chez les Eupleura deux groupes d'espèces: 1<sup>o</sup>) les petites espèces typiques (E. caudata, E. nitida), à varices continues d'un tour à l'autre. Ces espèces sont entièrement aragonitiques. 2<sup>o</sup>) Des espèces plus grandes (E. muriciformis, E. thompsoni foss.), où les varices sont décalées d'un tour à l'autre, et souvent réduites, sauf au dernier tour. Ces varices sont calcitiques, le reste de la coquille est aragonitique avec sans doute un cortex très mince. Je propose de réunir ces espèces dans un genre distinct que je nommerai PROEUPLEURA, espèce-type Eupleura muriciformis. Ce nom implique un caractère primitif car je pense que l'évolution s'est faite des espèces calcitiques (très nombreuses chez les Archeogastropodes) aux espèces aragonitiques (la presque totalité des espèces chez les Neogastropodes et les Pulmonés).

SYSTEMATICS OF GASTROPOD MOLLUSCS OF THE FAMILY CONIDAE.  
Alan J. Kohn, Department of Zoology, University of Washington,  
Seattle, Washington, U.S.A.

Most molluscan systematists place all extant species of the family Conidae in the genus Conus. In number of described species, this genus is among the largest in the animal kingdom. The number of available specific names exceeds 2700, of which about 1100 were proposed for species known only as fossils. One may only guess that the number of valid extant species is 400-200.

The most recent systematic study of the whole group is that of Tryon (1884), which relied heavily on earlier works. This report deals with early stages of an attempt to subject the Conidae to a study employing the methods and philosophy of the "new systematics". The ultimate goal is a synthesis of morphological and non-morphological information relevant to the process of speciation in Conus and the evolution of assemblages of large number of sympatric species common throughout most of the geographic range of the genus.

This paper reports studies made to date on type specimens, and it represents an effort to determine the identity of described recent species, many of which were inadequately described and/or illustrated poorly or not at all. As might be expected from the large number of specific names proposed, described species are often inadequately distinguished from their congeners. As the only proper use of a type specimen is as a name-bearer, it is of considerable importance to determine which species each name was intended to designate.

I consider a chronological approach a practical means of attaining this goal. Thus, all species described by Linnaeus in 1758 must be either (1) valid or (2) nomina dubia. All species of the first author after Linnaeus must be either (1) valid, (2) synonyms of Linnaean species, or (3) nomina dubia. This procedure can be pursued in chronological order toward the present, and it provides a singularly convenient framework for taxonomic study.

The critical aim of the study, an appreciation of the nature of each nominal species, is complicated by several factors, which will be discussed.

The 99 species described by seven authors between 1758 and 1791 have been studied to date. Type specimens of 28 species are known to exist and have been examined. For the others, 47 representatives of lectotypes and 3 neotypes will be established. The ratio of names now considered junior synonyms to valid described species rose constantly during the period studied. Fifty-nine of the species are now considered valid.

(Aided by a grant from the National Science Foundation.)

QUELQUES CONSIDÉRATIONS SUR LA FAUNE DES ISOPODES  
 TERRESTRES DE LA ROUMANIE. V. Gh. Radu. Académie de la République  
 Populaire Roumaine, Roumanie

Le groupe des isopodes en général, des isopodes terrestres en spécial est un des plus intéressants, autant du point de vue biologique, que du point de vue pratique, appliqué.

On a fait sur ce groupe de nombreuses études et pourtant beaucoup de problèmes en restent encore non résolus, non seulement sous les aspects de l'actualité et de la vaste perspective qu'en donne les moyens modernes d'investigation scientifique, mais aussi même dans leur aspect classique, par exemple de la systématique, de l'anatomie, de la zoogéographie etc.

Les recherches isopodologiques faites en Roumanie ont apporté, à la connaissance des isopodes, des contributions assez importantes du point de vue systématique et zoogéographique ainsi que du point de vue anatomique et cytologique. La faune des isopodes terrestres de Roumanie paraît être particulièrement riche et variée. Dans un délai de temps assez court, on a décrit plus de 50 espèces parmi lesquelles il y a pas mal d'endémismes. Dans le texte définitif on en citera les plus caractéristiques, appartenant surtout au genre *Tracheoniscus*.

Ce genre doit être considéré, d'après nos recherches, comme particulièrement intéressant pour notre faune isopodologique. Entre autres il paraît que le territoire de notre pays est le plus riche en espèces et variétés, d'où découle certaines considérations zoogéographiques. La liste de toutes les espèces trouvées en Roumanie sera donnée et en même temps quelques nouveaux critères morphologiques utilisés pour la délimitation des espèces.

Dans la seconde partie de la communication, on insistera sur la *Bifrontonia feminina*, récemment découverte en Roumanie et particulièrement intéressante de plusieurs points de vue, bien qu'elle ne puisse être considérée comme un vrai endémisme, par le fait qu'elle n'a pas été trouvée que dans les serres. On est donc très justifié à supposer qu'elle a été introduite chez nous avec les plantes exotiques de quelque région chaude du globe.

C'est une espèce parthénogénétique, mais elle appartient aux isopodes supérieurs (Pléurotrachéates), où ce phénomène est exceptionnel. Dans un texte concis et résumatif on montrera les divers aspects (biologiques, morphologiques, cytologiques, éventuellement aussi certains aspects histochimiques), de la parthénogénèse de cette espèce. On présentera des préparations et des diapositifs.

A CLASSIFICATION AND PHYLOGENY OF THE CHTHAMALIDAE (CIRRIPIEDIA: THORACICA). Victor A. Zullo, Systematics-Ecology Program, Marine Biological Laboratory, Woods Hole, Massachusetts. Research supported by the Ford Foundation and the Department of Paleontology, University of California, Berkeley.

The common "acorn" barnacles (Suborder Balanomorpha) are traditionally divided into two families: Chthamalidae and Balanidae. The chthamalids are considered more primitive phylogenetically and to have been derived from a lepadomorph ("goose-neck" barnacle) ancestor. Although the derivation of the balanids from the chthamalids is generally accepted, little evidence has been presented in support of this theory, and it has even been suggested (Withers, 1924) that the two groups arose independently from lepadomorph stocks.

Two groups are distinguished within the Chthamalidae. The first (Chthamalus-group), is characterized by a free rostrum and the absence of carinolaterals in the shell wall, either a "tridentoid" or "quadridentoid" mandible, and an unmodified Cirrus III. The second (Pachylasma-group) is characterized by a tripartite rostral plate (formed by fusion of rostrum with rostro-laterals), and the presence of carinolaterals in the shell wall, a "tridentoid" mandible, and Cirrus III partially or fully modified as a mouth appendage.

Two additional subdivisions of the Chthamalus-group are recognized. The first, including Octomeris, Chthamalus, and Chamaesipho, is characterized by a "quadridentoid" mandible, and the second, including Catophragmus, Chionelasmus, and Euraphia (the Chthamalus hembeli-group of Nilsson-Cantell, 1921) by a "tridentoid" mandible.

The evolutionary history of both groups has been one of reduction in the number of shell wall elements and modifications in feeding apparatus. In the Chthamalus-group shell wall reduction was accomplished primarily through exclusion of elements, and feeding modifications were confined to changes in mandibular structure. Reduction in the Pachylasma-group was achieved primarily by fusion of elements, and feeding adaptations involved the modification of Cirrus III.

These latter features also characterize the Balanidae which differ materially from the more phylogenetically-advanced members of the Pachylasma-group only in the structure of the labrum. It is therefore proposed that the Balanidae were derived from the Pachylasma-group stock.



SINOPSIS HISTORICA DE LOS ESTUDIOS SOBRE SYRPHIDAE ( DIPTERA )  
CHILENOS. María Etcheverry, Centro Estudios Entomológicos, Uni-  
versidad de Chile, Casilla 147, Santiago, Chile.

Al hacer el catálogo de la familia Syrphidae en Chile ha sido fundamental lograr todas las descripciones originales de las especies dadas para Chile. Al iniciar este trabajo nos hemos encontrado que de las 109 especies chilenas 64 fueron descritas en el siglo pasado y 45 en lo que va corrido de éste. Sólo 57 especies de las citadas para Chile han sido descritas sobre material colectado en el país. La mayoría de los trabajos en los cuales se han descrito estas especies no son revisiones completas ni analizan varias especies, sino que son tratadas en forma aislada.

Es en 1835 que Guérin hace la primera descripción de un Syrphidae chileno colectado en Chiloé; describe tanto el macho como la hembra de *Dolichogyna chilensis*. En 1837, Francis Walker, entomólogo inglés, describe dos especies colectadas en Chile durante el viaje del "Adventure" por el Estrecho de Magallanes. Entre 1842 y 1850, P.J.M. Macquart, entomólogo francés, describe 7 especies colectadas en Chile por Gay.

En 1852, Emile Blanchard, en Historia Física y Política de Chile, describe tres especies del material colectado por Claudio Gay. Entre 1853 y 1883, N.J.F. Bigot describe 7 especies chilenas sobre material colectado por M.Ph. Germain y C. Gay. En 1863, el Conde Camilo Rondani describe una especie a base de material enviado por el Dr. R.A. Philippi. En 1865, R.A. Philippi publica, en alemán, su trabajo sobre dípteros chilenos, y en ella describe 29 especies nuevas, gran parte colectadas en Valdivia. En 1867, F. Jaenicke describe una especie con material colectado por Cunningham. En 1868, el Dr. J.R. Schiner describe 2 especies colectadas en el país en el viaje de la fragata austríaca "Novara".

En 1935, el Dr. C.H. Curran describe una especie colectada en Valparaíso. Entre 1926 y 1927, R.C. Shannon describe 9 especies colectadas en gran parte por Faz y Bullock. Además una especie, *Valdivia darwini*, colectada por Darwin en su famoso viaje del Beagle. En 1933, R.C. Shannon y D. Aubertin describen 13 especies sobre material colectado por ellos en 1926 y revisaron los tipos de Walker, Bigot y Macquart. Entre 1937 y 1940, Enderlein describe 4 especies, colectadas principalmente en las Islas Juan Fernández. En 1949, F.M. Hull describe una especie sobre material colectado por don Carlos Stuardo. Entre 1950 y 1951, el Prof. C.L. Fluke describe 3 especies de *Volucella* colectadas en la provincia de Tarapacá en el verano de 1948 por la autora.

AEGYPTOCOCCUS, A NEW GENUS FOR INERMIS OF HALL (HOMOPTERA: COCCOIDEA-PSEUDOCOCCIDAE). Yehia M. Ezzat, Dept. of Zoology, University of Assiut, Assiut, Egypt, UAR.

The mealybug inermis of Hall had been chosen in 1948 as the generic type for Mirococcus Borchsenius. Lately, it was re-described as such by Williams (1958). The examination of its authentic material in the coccid collection, Ministry of Agriculture, Egypt, proved the presence of definite characters that did not appear in the recognition characters of Mirococcus or in the redescription of inermis.

This being the case, an illustrated redescription of this species is here submitted for the purpose of specific determination. Meanwhile, a new genus, Aegyptococcus, is proposed to solve the generic problem. It is unfortunate to create a new genus for the generic type of an established one. However, the existence of several other species in Mirococcus prohibited any amendment in its recognition characters, hence dictated the present attitude.

A REVIEW OF THE FAMILY ORIPODIDAE (ACARINA: ORIBATEI). Tyler A. Woolley, Dept. of Zoology, Colorado State University, Fort Collins, Colorado.

Since the original designation of the family Oripodidae Jacot, 1925, several changes have occurred in the taxonomy, including the discovery of new genera and species, as well as the exclusion of some genera and species erroneously placed in the family. Of the five genera originally included in the family, Oripoda Banks, 1904, and Gymnobates Banks, 1902, remain. Four new genera, Anoripoda Sellnick, 1959, Benoibates Balogh, 1959, Exoripoda Woolley, 1961, and Truncopes, Grandjean, 1956, are added to the family. Seven additional species are described together with explanations of the clarified characteristics of the family, and notes on interesting discoveries in the distribution of oripodids in North and South America, and Europe. A key to the genera and species is included also.

RATIFICACION DE LA SINONIMIA DE LATRODECTUS CURAÇAVIENSIS (MULLER 1776) = LATRODECTUS MACTANS (FABRICIUS, 1775) (ARANAE-AE). Berta S. Gerschman de Pikelin y Rita D. Schiapelli. Museo Argentino de Ciencias Naturales "Bno. Rivadavia". Investigadores del Consejo Nacional de Investigaciones Científicas y Técnicas. Buenos Aires, Argentina.

En nuestra publicación "Revisión del Gen. LATRODECTUS Walck., (1942 y Reimp. 1943), establecimos la sinonimia de L. curaçaviensis = L. mactans, basada en el estudio detallado de caracteres de su morfología externa, confirmando con la observación de una numerosa población de arañas de Colonia Dora, Argentina, la gran variabilidad de los mismos; lo que ya otros investigadores habían observado en L. mactans de otros países. Algunos aracnólogos siguieron buscando caracteres diferenciales para separar curaçaviensis de mactans. En 1958 (Levi) se mencionó una diferencia en la genitalia interna. (En la externa, epiginio, no hay ninguna diferencia). Como este estudio no lo habíamos hecho, esperamos las conclusiones de esa investigación; las que aparecen en 1959 dando Levi como carácter diferencial entre mactans y curaçaviensis el número de vueltas del ducto de las espermatecas en la hembra: 3 en curaçaviensis de América del Norte y 2 en la misma especie de América del Sud; mientras que mactans presenta 4 a 5 vueltas, salvo en Sud Africa en donde solo presenta 3. Además resuelve que L. mactans no se encuentra en la Argentina, llegando hasta el Paraguay; siendo L. curaçaviensis la especie que se encuentra en Argentina Y Chile.

Encontrando estos resultados un tanto contradictorios decidimos hacer nuestro propio estudio de la genitalia interna de las LATRODECTUS de la Argentina. Siguiendo la misma técnica que usó Levi y confirmando las observaciones con dibujos hechos con cámara clara, tratando en todos los casos de colocar la genitalia en la misma posición en que las dibuja Levi para evitar error en la comparación de los mismos. Los resultados obtenidos son:

En todos los ejemplares estudiados procedentes de distintas localidades desde el Chaco a Tierra del Fuego, el ducto presenta 3 o 4 vueltas. En algunos casos la vuelta media está un poco escondida entre las otras dos, pero siempre visible. Queda demostrado así que no hay diferencia en la genitalia interna de curaçaviensis y mactans y que el carácter de número de vueltas del ducto de las espermatecas de la hembra no es válido para la diferenciación de las especies porque varía en la misma especie y es igual en especies distintas. (En L. geometricus C. L. Koch hemos observado 4 vueltas). Como tampoco hay diferencia en la ecología, ni etología ni en la toxicidad de su ponzoña, debemos aceptar que en el estado actual de los conocimientos no hay carácter válido constante que separe a L. curaçaviensis de L. mactans por lo que ratificamos la sinonimia establecida en el año 1942: L. curaçaviensis (Müller) = L. mactans (Fabricius) y la presencia de L. mactans en la Argentina.

Por atención del Dr. Houssay quien nos ha obsequiado con 3 ejemplares de L. mactans katipo de Nueva Zelandia y un ejemplar de L. mactans tredecimguttatus de Israel hemos podido estudiar la genitalia de los mismos, contando en todos ellos 4 vueltas de ducto.

El único carácter constante de la genitalia interna por el que se puede diferenciar L. geometricus C. L. Koch de todas las otras especies del género es que en geometricus la primera vuelta del ducto envuelve la porción central de las espermatecas, mientras que en todas las otras especies, envuelve la parte anterior. Este carácter coincide con la diferencia de epiginio que solo se observa en geometricus siendo igual en todas las demás LATRODECTUS.

VALIDITE D'UNE DISTINCTION SPECIFIQUE ENTRE LES DEUX ACIPENSERIDES: ACIPENSER STURIO L. D'EUROPE ET ACIPENSER OXYRHYNCHUS MITCHILL D'AMERIQUE DU NORD. Etienne Magnin, Labor. de Zoologie, 25 rue du Plat, Lyon 2°, France.

Ces deux esturgeons sont des migrateurs anadromes vivant respectivement sur les côtes européennes et américaines de l'Atlantique. En plus de l'identité de leur mode de vie, ils présentent encore une grande ressemblance morphologique générale: aussi sont-ils souvent considérés comme une seule et même espèce, Acipenser sturio L.

Une comparaison plus poussée montre néanmoins entre ces deux poissons toute une série de caractères distinctifs tant au point de vue morphologique ( nombre et forme des écussons osseux, forme des scutelles dermiques situées entre les écussons, nombre de branchiospines, couleur des viscères...) qu'au point de vue morphométrique (différences significatives entre les équations de régression donnant les relations entre les différentes parties du corps et la longueur totale ou entre les différentes parties de la tête et la longueur de la tête).

Ce faisceau de caractères semble bien confirmer la validité d'une distinction spécifique entre les deux esturgeons étudiés. L'esturgeon migrateur des côtes atlantiques de l'Amérique du Nord doit donc être appelé Acipenser oxyrhynchus MITCHILL 1815.

APPROACH TO A BIOCHEMICAL TAXONOMY THROUGH SCREENING OF BIOGENIC AMINES AND POLYPEPTIDES IN THE SKIN OF SOUTHAMERICAN AMPHIBIANS. Vittorio Erspamer, Istituto di Farmacologia, Università di Parma, Italy - José M. Cel, Instituto de Biología, Universidad Nacional de Cuyo, Mendoza, Argentina.

Screening of the content of biogenic amines and polypeptides in Amphibian skin may offer a valuable key for the biochemical taxonomy of this Vertebrate group. Phenylalkylamines, imidazolalkylamines, and indolalkylamines were specially considered. Eluates of crude acetone or methanol extracts of the skins were chromatographed on paper, and assayed biologically. Characteristic patterns for different families, genera and species were recorded. They generally agree with their morphological and systematic position. Results are particularly interesting in the genera *Leptodactylus*, *Bufo* and *Phyllomedusa*, and in many other genera of *Leptodactylidae*, *Bufo* *idae*, *Atelopodidae*, *Hyllidae* and *Ranidae*.

VARIATION IN THE SNAPPING TURTLE CHELYDRA SERPENTINA: A STUDY IN  
QUANTITATIVE SYSTEMATICS. Robert C. Feuer, Dept. of Zoology and  
Entomology, The University of Utah, Salt Lake City 12, Utah, U.S.A.

Morphological variation and systematics of the snapping turtles of the genus Chelydra have never been well understood despite their abundance in the northern part of their range. Chelydra s. serpentina is well represented in museum collections; the Neotropical taxa are not. The genus ranges from Southeastern Canada to Ecuador and from the Atlantic Ocean to the Rocky Mountains. Three taxa are allopatric with gaps between their distributions, in Northern Mexico and Southernmost Texas and in Nicaragua, separating them. A fourth taxon is found mostly on the Florida peninsula, rarely in Georgia and Alabama.

Mahalanobis' Generalized Distance, Student's T Test and other statistical techniques are used to study the morphological and meristic characters of the group in the hope of determining the natural groupings within the genus. Individual, geographic, and sexual variation are also included in the study.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

7. ZOOGEOGRAPHY



ZOOGEOGRAPHICAL RELATIONSHIPS AND POST-GLACIAL DISPERSAL OF  
LITTORAL MARINE INVERTEBRATES OF EASTERN CANADA.

E. L. Bousfield

National Museum of Canada, Ottawa, Canada.

The intertidal and inshore marine waters of eastern Canada, from Belle Isle Strait to the Gulf of Maine, are regionally classified as sub-arctic, cold-temperate (boreal), or warm-temperate (Virginian), according to mean summer surface temperatures and to zoogeographical affinities of the predominant species of crustaceans, mollusks, and polychaete worms. The pseudo-anomalous distribution of the fauna, in which reproductive cold-stenotherms are dominant in northern and southern areas and warm-stenotherms in central regions, is the result of major changes in the coastal marine environment subsequent to Pleistocene glaciation of adjacent land masses. Biological and geological evidence is combined in a step-wise portrayal of the probable sequence of events. During the Hypsithermal Period (c. 8,000 b.p.) warm-stenotherms spread northward in a continuous population from the middle Atlantic region, mainly via the relatively warm and shallow waters of the Scotian shelf, into the Gulf of St. Lawrence. Subsequent deepening and cooling, particularly in the Gulf of Maine, eliminated many species of warm-stenotherms from eastern Canada, restricted the remainder essentially to one large area, the south-western part of the Gulf of St. Lawrence, and enabled the cold-stenotherms to repopulate southern areas such as the Bay of Fundy. Small estuarine populations of hardier species, widely isolated along the coasts of northern New England and Nova Scotia, mark the former dispersal route of the warm-stenotherms.

ON THE ORIGIN AND RELATIONSHIPS OF THE ARCTIC  
OCEAN ABYSSAL MOLLUSK FAUNA. Arthur H. Clarke, Jr.,  
National Museum of Canada, Ottawa.

Sixty-three of the approximately 1160 known species of abyssal mollusks (i.e. those living at 1000 fm and deeper) have been recorded from the Arctic Ocean. Many of these are eurybathyal and their distribution beyond the Arctic is closely related to the depth of the sills which surround that region and to the ability of the individual species to exist at depths equal to or less than the depth of these sills. For example, only species known to live at depths of less than 30 fm also occur south of the Bering Strait (sill depth 30 fm), only species living at depths less than 125 fm also occur in Baffin Bay (sill depth 125 fm at Smith Sound), and only species living at depths less than 305 fm also occur in the West Europe Basin south of the North Atlantic Transversal Ridge (sill depth 305 fm). An abyssal connection exists between the Arctic Ocean and the Norway and Greenland seas and 81% of the Arctic abyssal species also occur in that region. Eight abyssal species are endemic to the Arctic Ocean and all of these exhibit relatively stenobathyal distribution.

Geological and paleontological evidence indicates that the three sills cited have probably been in existence, either as sills or as land bridges, since the early Tertiary. Since two of the endemic stenobathyal species (Nucula zophos and Ledella tamara) have no close relatives in the North Atlantic or the North Pacific, it is possible that they or their ancestors, and perhaps other elements of the fauna, may have migrated into the Arctic during the Mesozoic or early Tertiary from a presently unknown source. The other species appear to be more recent arrivals. Except for the ultra-eurybathyal component (<30 fm), they were probably derived from the North Atlantic primarily by way of the Norwegian and Greenland seas. The ultra-eurybathyl group (38 spp.) was probably derived both from the Atlantic since the early Tertiary and, like Neptunea, from the Pacific during the early Pleistocene.

On the basis of abyssal mollusk faunas, the Norway and Greenland basins belong to the same zoogeographic province as the Arctic basins but, contrary to published opinion, the Baffin Basin is more similar to the Labrador and Newfoundland basins.

TEMPERATURE AND THE GEOGRAPHICAL DISTRIBUTION OF LUGWORMS  
(ARENICOLIDAE, POLYCHAETA). G.P.Wells, Dept. of Zoology,  
University College, London.

Lugworms generally live in littoral or sublittoral flats of sand or muddy sand, which they consume. The hind end of the body is modified to form an achaetous tail. Twenty-four species or subspecies are recognised, grouped in two sharply distinct genera (Arenicola, Abarenicola).

From the standpoint of lugworm zoogeography, the world is divided into three great zones, roughly bounded by the 20° surface-water isotherms for August in the Northern and February in the Southern Hemisphere. A species may spread very widely within a zone but (except for overlap at the boundaries) no species is found in more than one zone.

The cool waters to the North have Arenicola marina with 3 subspecies, Abarenicola claparedii also with 3 subspecies, and Abarenicola pacifica. The Abarenicolae of this zone have lost their statocysts, and show other evidence of close relationship.

The warm water zone between the 20° isotherms is practically monopolised by four closely related species of Arenicola (the 'cristata group' of species).

The cool waters to the South show a sorting of the lugworm fauna according to the coastal water types distinguished by Knox (1960). Arenicola loveni, with 2 subspecies, is on Warm Temperate shores. The Cold Temperate Mixed water has most of the Abarenicolae with statocysts (Abarenicola affinis with 4 subspecies, A. gilchristi, and 2 of the subspecies of A. assimilis) and also, apparently, the only two recorded specimens of the aberrant, cystless Abarenicola pusilla. The remaining 3 subspecies of Abarenicola assimilis are very closely related to each other, and occur in Sub-Antarctic Cold Temperate waters.

It will be noted that the temperature zones are characterised by endemic groups of related forms. Therefore, their lugworm faunas must have been separated for long enough to allow a considerable degree of evolutionary differentiation to take place within each zone. The existence of morphologically distinguishable local populations (subspecies) of several of the more widely ranging species shows that there are resistances to diffusion, which obstruct, but do not altogether prevent, the wide spread of a species within a temperature zone. The frontiers of the temperature zones appear to be barriers of a higher order of impregnability.

BARRIERS BETWEEN TROPICAL PACIFIC AND INDIAN OCEAN EUPHAUSIID SPECIES (ZOOPLANKTON, CRUSTACEA). Edward Brinton, Marine Life Research Group, Scripps Institution of Oceanography, University of California at San Diego, La Jolla, California, U. S. A.

Oceanic zooplankton occupying waters of the Indo-Australian Archipelago are mainly tropical (equatorial) species, common to both the Indian and Pacific Oceans. The more oceanic (pelagic) of these species are present in only a small part of the Pacific sector of these waters, usually the deep basins. Investigations by the Naga Expedition, 1959-1961, indicated that subtropical Pacific species are not carried southward in the South China Sea beyond about 10°N, and are not found in the broad neritic environment of the Sunda Shelf. Similarly, the Arafura Sea is too shallow for oceanic euphausiids. Thus, most of the waterways between the two oceans do not serve as pathways for euphausiid species.

Certain bisubtropical species having northern and southern hemisphere ranges that merge in the western Pacific (e.g. Euphausia mutica) are sometimes present in low density in samples from the Banda and Timor Seas. Such occurrences suggest that even species of the central Pacific water masses may be in partial communication with populations of the same species in the Indian Ocean. The only deep east-west passage for equatorial and central oceanic species is near Timor, and flow is predominately from east to west.

A recent route for warm-water species does not seem to exist south of Australia. There, the oceanic fauna is temperate.

Basins of the Indo-Australian region provide a tortuous pathway for east-west exchange of zooplankters, but one which may be responsible for the Indian-Pacific co-occurrence of tropical and even certain subtropical zooplankters.

Annual changes in the ranges of euphausiids of the region are slight. Seasonal reversal of the circulation pattern does not provide even short-term conditions in which oceanic species are sustained in the extensive neritic areas.

**EVOLUTION AND DISPERSAL OF CONTEMPORARY VERTEBRATES IN EASTERN NORTH AMERICA. Joseph H. Waters, Dept. of Zoology, Duke University, Durham, North Carolina, U.S.A.**

Recent published and unpublished studies provide additional information regarding evolution and dispersal of contemporary vertebrates in and east of the Appalachian Mountains of eastern North America during and following the Wisconsin glaciation.

At the height of glaciation tundra plants and animals occurred just south of the ice sheet, boreal species in the central and southern Appalachians, and temperate species throughout much of southeastern United States except at higher altitudes. Several vertebrate species, including some of South American origin, entered southeastern United States from Texas and Mexico during the Pleistocene. During the Wisconsin glaciation some vertebrate populations were divided, and animals occurred in refugia: the southwest, the southern Mississippi River and tributaries, the southern Appalachians, and Piedmont and continental shelf areas of southeastern United States. Some populations differentiated during occupation of refugia.

Postglacial dispersal of some vertebrate species occurred along broad fronts; others were restricted to the Appalachians or the coastal plain. Several fresh water fishes, amphibians, and turtles dispersed eastward from the Great Lakes region by way of glacial meltwater outlets. Clinal differentiation took place, and some previously separated, closely related, populations hybridized as they came together in the northeast. Some incipient species populations became reproductively isolated. Movements of terrestrial vertebrates were probably closely correlated with isothermic shifts and movements of plant ecotypes.

Eastward extension of the Prairie Peninsula in later post-glacial times resulted in dispersal of some prairie vertebrates as far as the Atlantic coast, division of woodland populations into northern and southern segments, and northward range shifts of some southern species. Some populations differentiated into new subspecies, and replacement of prairie by mesic forests produced some eastern relict populations. Minor climatic fluctuations since then have produced some north-south range shifts, but no important differentiation. Relict populations on New England coastal islands, created as sea levels rose, have also undergone relatively little differentiation.

THE POST GLACIAL DISPERSAL OF AMERICAN CARIBOU,  
A. W. F. Banfield, National Museum of Canada, Ottawa,  
Ontario, Canada.

A quantitative study of 704 recent and 57 sub-fossil caribou specimens led to the recognition of six Western Hemisphere subspecies of the Holarctic reindeer, Rangifer tarandus (Linne). These allopatric subspecies displayed a broad pattern of concordant characters and marginal intergradation. The whole population also exhibited a mosaic of individual characters which were considered indicative of local demes below the subspecific level.

The subspecies can be arranged in three supra-subspecies groups of approximate equal taxonomic rank: mainland tundra taxa (R. t. granti and R. t. groenlandicus); Arctic insular taxa (R. t. pearyi and R. t. eogroenlandicus); and forest taxa: (R. t. caribou and R. t. dawsoni). When the distributions of the subspecies were plotted on a map of the Last (Wisconsin) Glaciation, it was noticed that an unglaciated refuge was available in the heart of the range of each group: Beringia, the continental tundra refuge; Pearyland for the Arctic insular group; and the periglacial Continental forested refuge for the woodland group. The finding of the late-Pleistocene caribou remains in each of these refugia confirms their occupation during the Wisconsin stage. It is also noteworthy that present areas of intergradation centre on the boundaries of these refugia.

Although the evidence points to the evolution of most of these subspecies in situ, there are certain anomalies in the distribution pattern that can best be explained by emigration into corridors which are known to have become ice-free early in the deglaciation process.

Such reasoning explains the northern extension of woodland caribou in the Mackenzie Valley, along the Cordilleran-Laurentide Ice Sheet border; the evolution of dawsoni in relative isolation on the Queen Charlotte Islands after reaching the islands soon after their exposure; and the eastward expansion of groenlandicus to the Keewatin tundra, Baffin Island and southwestern Greenland, along the northern boundary of the shrinking Laurentide Ice Sheet while much of northeastern Canada was unavailable to southern populations of caribou.

COMPOSITION AND ORIGIN OF THE TENEBRIONID FAUNA OF NORTH WESTERN SOUTH AMERICA AND THE WEST INDIES. Giorgio Marcuzzi, Dept. of Zoology, University of Padua, Italy.

The Tenebrionid fauna of North Western South America and the West Indies is constituted by nearly 420 species, distributed in 123 genera and 30 tribes. 75% of the species are endemics. These particularly belong to the "Melasomes". There is no affinity at the species level between Tenebrionid faunas of Venezuela, Columbia and the Antilles; at the generic level there is a slight affinity between Venezuelan and Columbian faunas; at the tribus level on the contrary there is an affinity amongst all the three faunas. The entire Tenebrionid fauna of this region is constituted by genera or tribes whose present area of distribution is of the pattern called by Mayr "pan tropical" and by Vandel "gondwanian". More precisely, we can recognize with Vandel the following categories: 1) generalized gondwanian type; 2) partial gondwanian type. Within this category we can furthermore recognize taxa present in Africa and Asia or in the Pacific Region, besides South America, and taxa present exclusively in America. Within this category there are taxa present exclusively in South America, or in South and Central America, or, finally, in South, Central and North America (Mayr's "pan american" category). Some taxa are present only on the Antilles. There is a remarkable parallelism between distribution and systematics of Antillean Tenebrionids and the geological history of this region, and particularly between the number of endemic genera, species and subspecies and the age of the different islands.

ZUR GEOGRAPHISCHEN VERBREITUNG DER GATTUNG FORMICA  
IN EUROPA, Karl Gösswald, Institut für Angewandte  
Zoologie der Universität Würzburg, Deutschland.

Die waldhygienische Bedeutung der Roten Waldameisen der Gattung *Formica* gab Veranlassung zur Untersuchung ihrer geographischen Verbreitung. Auf Grund zahlreicher Sammelexkursionen und einer Auswertung des europäischen Museumsmaterials wurde die geographische Verteilung von 7 *Formica*-Arten (*F. rufa* L., *F. polyctena* Foerst., *F. lugubris* Zett., *F. aquilonia* Yarrow, *F. nigricans* Em., *F. cordieri* Bond. und *F. uralensis* Ruszky) bearbeitet. *F. polyctena* ist im wesentlichen im mitteleuropäischen Tiefland und in den Voralpen zu finden. Die Art fehlt in England, Schottland, Irland und Norwegen. In Südeuropa ist sie nur vereinzelt anzutreffen. *F. rufa* zeigt eine ausgedehntere Verbreitung als *F. polyctena*. Man findet sie zwar auch in der Ebene angereichert, sie steigt aber in den Alpentälern bis ca. 1800 m auf. *F. rufa* fehlt in Irland und Norwegen. Im Süden wird ihr Vorkommen etwa durch den 42. Breitengrad abgegrenzt. Die beiden mehr im offenen Gelände verbreiteten Arten *F. nigricans* und *F. cordieri* haben den Schwerpunkt ihrer Verbreitung auf Grund ihrer stärkeren Thermophilie nach Süden verlagert. Wir finden *F. cordieri*, die wahrscheinlich thermophilere der beiden Arten, im Apennin, Südfrankreich, Pyrenäen und Jugoslawien. *F. nigricans* kommt im Norden noch in Lettland, Estland und vereinzelt auch in Finnland vor. Typische Gebirgsbewohner sind *F. aquilonia* und *F. lugubris*. *F. aquilonia* findet sich vor allem in den Ostalpen und Karpaten, im schottischen Hochland und Skandinavien nördlich des 55. Breitengrades, wo sie bis in die finnische Seenplatte hinunterreicht. *F. lugubris* hat ihren Verbreitungsschwerpunkt in den Westalpen und Pyrenäen. Sie besiedelt aber auch deutsche und französische Mittelgebirge (Schwarzwald, Bayerischer Wald, Vogesen). Im Norden findet man sie in Britannien und Skandinavien. Das heutige Verbreitungsbild der *Formica*-Arten läßt sich nur aus der Sicht der eis- und nacheiszeitlichen Klimagestaltung deuten.



ОТНОСИТЕЛЬНО ВЕРТИКАЛЬНОЙ ЗОНАЛЬНОСТИ НАСЕКОМЫХ -  
ФИТОФАГОВ В ГОРНЫХ СТРАНАХ НА ПРИМЕРЕ ГРУЗИНСКОЙ  
ССР. Д.Н. Кобахидзе, Институт зоологии, Тбилиси, СССР.

Комплекс насекомых - фитофагов влажно-субтропической зоны Грузинской ССР складывается: а) из широко распространенных видов, обитающих в старой Колхиде; б) из широко распространенных видов, с большим экологическим диапазоном, проникающих со смежных территорий; в) из более специфических видов-иммигрантов, сопутствующих субтропическим культурам.

Насекомые-фитофаги полупустынно-степной зоны по своему происхождению не одинаковы (туранские пустынные виды, иранские виды, пустынно-средиземноморские виды и т.д.). В равнинной части полупустынно-степной зоны характерны эндемики.

Большое видовое разнообразие фитофагов отмечено в лиственных лесах нижнего горного пояса; меньше видовое разнообразие в хвойных лесах верхнего горного пояса. Кроме общепалеарктических и европейско-сибирских видов отмечены некоторые бореальные виды. Имеются и кавказские эндемики.

Насекомые в зоне субальпийского редколесья и субальпийского разнотравья богаче, чем в зоне альпийских лугов (большинство - эвризональные и эвритопные виды, но имеются и высокогорные эндемики). Часть видов проникла с севера во время оледенения; другие - эндемики бореального происхождения.

"Средняя зона" - разнотравные степи, смешанные леса - в видовом отношении богаче фитофагами, чем "крайние зоны".

Насекомые-фитофаги с ограниченным широтным распространением ограничены также в своем вертикальном распространении и, наоборот, насекомые-фитофаги с большим широтным распространением широко распространены и по вертикальным зонам.

PHYLOGENETIC RELATIONSHIPS AND GEOGRAPHICAL DISTRIBUTION  
OF SOME ORIBATEI (ACARI) FROM ANTARCTICA. John A.  
Wallwork, Dept. of Zoology, Westfield College, University  
of London, London N.W. 3, England.

Oribatid mites constitute a significant proportion of the terrestrial fauna of the Antarctic and sub-Antarctic, although fewer than 20 genera have been recorded to date. Studies of species distribution and phylogenetic relationships between groups may provide corroborative evidence, in conjunction with geological and paleontological data, for the theory of Continental Drift. Distribution of species and sub-species populations of the genera Alaskozetes, Pertorgunia, Podacarus, Maudheimia, Oppia, Ceratozetes and Liebstadia is discontinuous and isolation has frequently resulted in speciation along well defined lines leading to a progressively stronger expression of sexual dimorphism. Local distribution patterns of Podacarus, Alaskozetes and Pertorgunia are correlated with food supply and a high degree of tolerance of littoral conditions. Interpretations of allometric growth patterns and setal progression and regression in several common species indicate the phylogenetically advanced development of morphological characters, which can be correlated with adaptations to extreme conditions of low temperature and low humidity. Faunal differences between East and West Antarctica support the geological division of this region into Gondwana and Andean provinces. The two genera recorded from the Eastern or Gondwana province are Maudheimia, which appears to be a true endemic, and Alaskozetes, a marginal representative of the Western or Andean fauna. The fauna of Macquarie Island has two components, namely a group of endemic species belonging to the families Camisiidae, Podacaridae, Ceratozetidae and Galumnidae, and a second group of species with Andean affinities. Similarities between the fauna of Macquarie Island, the South Shetland-Antarctic Peninsula region and the South American Andes suggest probable genetic contact in earlier geological time between communities now widely separated. The present pattern of species distribution over these regions may reflect a former continuous distribution which became fragmented and impoverished as a result of land movements during the Mesozoic and the development of increasingly cold and dry conditions during the Tertiary and Quaternary periods.

WALLACEA AND INSULAR FAUNA OF MILLIPEDES. Yu-hsi Moltze Wang,  
Dept. of Zoology, National Taiwan University, Taipei, Taiwan,  
China.

Wallace (1860) and Weber (1907) placed Japan, Taiwan and Philippines within their lines separating from Australian region. Matthews (1906) suggested Philippines as an intermediate land connecting Oriental and Australian regions. Dickerson (1928) modified the Wallacea by separating Japan and Taiwan from Philippines. Kano (1936) placed Botel Tobago to Philippine province.

Of 54 species representing 24 genera were found in Philippines, 39 about 75% are endemic, none of that were cosmopolitan in distribution, five, 9.2% are common to Borneo, Java and Rangoon. Only one species, 1.88%, has thus far been found occurring in Australian region.

Of 51 species representing 24 genera were found in Taiwan, 39, 76.5% are endemic. Nine, 17.5% are common to Palaearctic China Mainland, Riu-kiu, Japan and Korea. Two each, 3% each are common to Philippine, Java, Rangoon and have thus far been found occurring in Australian region. As in Botel Tobago, only four species were found, none common to Philippines, but three are common with Taiwan. (indicating a little the diagonal ruling to Philippines).

Of 29 species representing 15 genera were found in Riu-kiu. 26, 90% being endemic, two, 7% being common to Oriental Fukien and Java, only one, 3% being common to Palaearctic Japan.

Of 190 species representing 57 genera were found in Japan, 178, 93% being endemic, six, 3.2% common to Taiwan, four, 2.9% common to other Palaearctic, only two, 1.4% extending to Australia.

Mayr (1944) showed the avifaunal balance between Oriental and Australian region of Weber line. Several entomologists and Gressitt (1958) suggested in view of insect distribution, disregarding the Wallace and Weber lines. According to diplopoda fauna, Wallacea seems to be appropriate.

THE SYSTEMATICS, ORIGIN AND HISTORY OF DISTRIBUTION OF  
THE EURASIATIC AND NORTH AMERICAN SPECIES OF PERCA,  
LUCIOPERCA AND STIZOSTEDION. A.N. Svetovidov, Zoologi-  
cal Institute, Academy of Sciences, Leningrad, U.S.S.R.

A few families of fresh-water fishes common to Eurasia and North America are represented in the both continents by identical species, subspecies of the same species or by congeneric species. Of special interest in many respects is the Percidae. It is not clear if Perca is represented in Eurasia and North America by species or by subspecies of the same species as well as if the European species of pikeperches are referred to Lucioperca and American ones to Stizostedion or should be united under one name.

The study of general and osteological characters enables to state that the European and North American perches should be recognized as subspecies, P. fluv. fluviatilis and P. fluv. flavescens. The perch of the Kolyma River, being intermediate between them in the main characters, is described as P. fluv. intermedius subsp. n. There are no such differences in general and craniological characters between Lucioperca and Stizostedion as those from other genera of the family, from Perca in particular. L. marina is intermediate between the both genera. Therefore, there is no reason to divide the both genera and these are united under one name, Lucioperca.

The considerations on the origin and history of distribution of the genera studied are given. Fossil remains of the both genera have been reported from Western Siberia and adjacent regions, those of Perca beginning from the middle and lower Miocene and of Lucioperca from the Oligocene. In Europe the fossil remains of Perca have been found in the Pliocene and those of Lucioperca in the bordering strata of the Tertiary and Quarternary formations. From North America the fossil remains of Percidae are reported only in the Pleistocene. All these facts and the recent distribution indicate the Palaearctic origin of the subfamily Percinae, including the both genera studied, and the migration of P. fluviatilis to North America through Behringian land. Because of systematic relationship between the North American species of Lucioperca and L. marina, which inhabits the Caspian Sea and brackish parts of the Black Sea, the migration of the genus to North America along the land connection across the Atlantic is suggested.

СИСТЕМАТИКА И ИСТОРИЯ ПРОИСХОЖДЕНИЯ И РАССЕЛЕНИЯ ЕВРОПЕЙСКО-АЗИАТСКИХ И СЕВЕРОАМЕРИКАНСКИХ ВИДОВ PERCA, LUCIOPERCA И STIZOSTEDION. А.Н. Световидов, Зоологический Институт Академии Наук СССР, Ленинград.

Немногие семейства пресноводных рыб, общих Евразии и Северной Америке, представлены на обоих континентах идентичными видами, подвидами того же вида или видами одного и того же рода. Среди этих семейств особо интересно во многих отношениях сем. Percidae. Не вполне ясно, представлен ли род *Perca* в Евразии и Северной Америке особыми видами или подвидами одного вида. Не обоснованы также мнения, относятся ли европейские виды судаков к *Lucioperca*, а североамериканские к *Stizostedion* или их следует объединить в один род.

Изучение внешнеморфологических и остеологических признаков позволило установить, что европейский и североамериканский виды *Perca* должны рассматриваться как подвиды, *P. fluv. fluviatilis* и *P. fluv. flavescens*. Промежуточный между ними по основным признакам окунь *p.* Колымы описан как *P. fluv. intermedius* sbsp. n. Между *Lucioperca* и *Stizostedion* нет таких внешнеморфологических и остеологических отличий, как от других родов семейства, в частности, от *Perca*, а *L. marina* по основным признакам занимает промежуточное положение между европейскими и североамериканскими видами. Поэтому нет оснований разделить относящиеся к ним виды на два рода и они объединены в один род *Lucioperca*.

На основании сведений об ископаемых остатках высказаны соображения о происхождении и расселении изучаемых родов. В ископаемом состоянии оба рода известны из Западной Сибири и прилегающих районов, *Perca* — начиная со среднего или нижнего миоцена, *Lucioperca* — с олигоцена. В Европе остатки *Perca* найдены в плиocene, *Lucioperca* — в пограничных горизонтах третичного и четвертичного периодов. В Северной Америке окуневые появились в плейстоцене, в неогеновых отложениях они неизвестны. Эти данные, а также современное распространение свидетельствуют о палеарктическом происхождении подсем. Percinae и обоих изучаемых родов и о расселении *P. fluviatilis* в Северную Америку через Берингию. Последнее подтверждается также нахождением остатков *P. fluviatilis* в четвертичных отложениях к востоку от его современного ареала. Отсутствие ископаемых остатков *Lucioperca* в третичных отложениях Европы и Восточной Сибири не дает достаточных оснований для суждения о пути его расселения в Северную Америку. Судя по систематической близости *L. marina*, живущего в солоноватых водах Черного и в Каспийском море, с североамериканскими видами, можно лишь предполагать, что расселение *Lucioperca* могло произойти по солоноватым частям морей вдоль сухопутной связи Европы с Северной Америкой.

ZOOGEOGRAPHICAL DISTRIBUTION OF THE OTIDIDAE  
WITH SPECIAL REFERENCE TO INDIAN SPECIES.

R.S. Dharmakumarsinhji, Dilbahar, Bhavnagar, India.

The main purpose of this paper is to focus attention on the unequal distribution of the family OTIDIDAE in the zoogeographical regions of the world, laying emphasis on the number of species occurring in different regions with special reference to Indian species.

International field ornithologists have already reviewed the position of the family and have stressed the importance of preserving vanishing species. Nevertheless, the need of assessing the distribution of the Bustards depicting the geographical position of the various genera and species in relation to each other is to assist field ecologists studying the life-history of different species.

Bustards are decreasing in most parts of the world and their habitats have been seriously interfered by Man. Apart from human persecution, their slow growth and production appears to be an inhibitory factor to their rapid increase. No attempt is made in this paper to give reasons for the diminishing populations or to mention environmental conditions affecting their propagation or survival. Yet the author makes exception to compare size of various species and also to show normal clutch-size laid by each species; he also draws attention to the general color patterns which when correlated with their breeding behaviour and environment may reveal basic factors determining their evolution.

This summation is extremely interesting and would be of help to zoologists and naturalists all over the world. The author gives a clear picture of the distribution of India's endemic species and compares their classification with other genera found elsewhere. In this the Ethiopian affinity is clearly seen.

L'ORIGINE ET LA DISTRIBUTION GEOGRAPHIQUE DE LA FAUNE DE LA REPUBLIQUE POPULAIRE ROUMAINE. Mihail A. Ionescu, Acad. R. P. R., Bucarest, Roumanie.

La composition faunique d'une région est en étroite liaison avec l'évolution paléogéographique et paléoclimatique du terrain respectif, au cours des dernières périodes géologiques.

Ce travail traite des transgressions marines qui eurent lieu sur le territoire roumain et de l'évolution de ces transgressions, de la glaciation quaternaire, de l'évolution postglaciaire du climat ainsi que des microzones de refuge de la faune.

En Roumanie, des travaux de zoogéographie ont été élaborés se rapportant à ce pays ainsi qu'à des territoires plus vastes. Parmi les zoologues et les zoogéographes, l'auteur mentionne K. Holdhaus, A. Caradja, C. Hormuzachi, Em. Racovitza, R. Jeannel et il expose brièvement leurs conceptions zoogéographiques.

Ce travail traite ensuite de l'origine des différents groupes fauniques et de leur distribution géographique en Roumanie, tant en ce qui concerne la faune terrestre que celle aquatique et cavernicole. Distribution horizontale et verticale.

L'auteur montre par des exemples que la faune de la Roumanie est composée d'éléments rélictés préglaciaires (tertiaires), de reliques glaciaires, des immigrants venus des diverses zones biogéographiques d'Europe: Europe Centrale, Europe Occidentale, Sous-région Méditerranéenne, Steppes Orientales (Steppe de l'Union Soviétique).

Du fait de la situation géographique de la Roumanie, entre l'Europe Centrale, la Sous-région Méditerranéenne et les Steppes Orientales, la faune de la majorité des groupes d'animaux est d'origine hétérogène. C'est ainsi qu'il existe des éléments Eurosibériens (Eurasiatiques), Boréo-alpins, Méditerranéens et Pontiques.

L'auteur traite ensuite des Endémismes de Roumanie et termine par la Bibliographie zoogéographique.

THE SOUTHERNMOST OCCURRING ANIMALS. J. Linsley Gressitt,  
Chairman, Entomology Dept., Bernice P. Bishop Museum,  
Honolulu 17, Hawaii.

The southernmost known free-living permanent inhabitants among animals are mites and springtails, at nearly  $84^{\circ}$  S. Lat. Possibly these, or protozoans, rotifers or tardigrades may occur a little farther south. The southernmost species, and some of their genera, are endemic, as are most of those at higher altitudes and lower latitudes. These elements appear well adapted to their rigorous niche, a chalikosystem (bare gravel), or in more favorable environments a limited bryosystem. Some at lower altitudes (to nearly  $78^{\circ}$  S.) seem less well adapted, and may be more recent air-borne immigrants to Antarctica. These animals live where wind prevents snow accumulation, generally on nunataks, ridges between glaciers, and exposed peaks and capes, and where the exposed rocks are warmed by solar radiation in summer (air temperature above the substrate is generally below  $0^{\circ}$  C.). Winter temperatures in the substrate are not known, but may be well below  $-60^{\circ}$  C. Over 50 species of land arthropods are known from the continent, including one flea and about 25 kinds of lice on birds and seals.



XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

9A. ECOLOGY

**ADAPTATIONS THERMIQUES DE QUELQUES PROTOZOAIRES LIBRES ET PARASITIQUES. Georges I. Poljansky, Institut de Cytologie Acad. Sc. URSS, Leningrad, URSS.**

Au XV Congrès Zoologique International à Londres nous avons présenté, il y a 5 ans, les premiers résultats de nos recherches sur les adaptations thermiques des Protozoaires. Le collectif de notre laboratoire poursuit l'analyse de ce problème.

Pour une série des espèces des Ciliés libres nous avons démontré que la thermostabilité, mesurée par le temps de survie dans les températures lethales haute, change dans les limites très larges dépendant du régime thermique de la culture. Les Protozoaires endoparasitiques des hôtes poikilothermes (les Ciliés et les Opalines) montrent la même variabilité de la thermostabilité, dépendant de la température du milieu, des particularités écologiques de l'hôte, des stades du cycle sexuel de l'hôte etc.

La stabilité envers les températures basses ainsi qu'envers le refroidissement profond (jusqu'à  $-10-15^{\circ}$ ) dépend aussi de la température précédente de la culture. Une analyse comparée des changements de la stabilité des Protozoaires envers les températures hautes et basses permet de supposer que les adaptations thermiques sont liées aux changements des protéines cytoplasmiques possédant des caractères de la dénaturation réversible. Les adaptations aux différents régimes thermiques sont liées aussi aux changements profonds du caractère du métabolisme. Ainsi chez *Paramecium caudatum* cultivée à  $28-29^{\circ}$  l'oxydation se réalise principalement à l'aide du système de la cytochrome oxydase. Dans les températures plus basses dominent les ferments du groupe du flavine. Enfin dans les températures basses ( $4-5^{\circ}$ ) c'est la glycolyse anaérobie qui joue le rôle dominant. Les changements du caractère du métabolisme qui s'effectuent dans le processus de l'adaptation des Ciliés aux températures variées, s'expriment aussi dans les variations de la quantité du glycogène et des lipides. Les températures basses favorisent leur accumulation dans le cytoplasme.

La capacité largement exprimée de la variabilité adaptative présente un caractère typique des Protozoaires, comme des êtres au niveau cellulaire d'organisation.

**ТЕМПЕРАТУРНЫЕ АДАПТАЦИИ НЕКОТОРЫХ СВОБОДНОЖИВУЩИХ И ПАЗАЗИТИЧЕСКИХ ПРОСТЕЙШИХ. Ю.И.Полянский, Институт Цитологии Академии Наук СССР, Ленинград, СССР.**

ХУ Зоологическому Конгрессу в Лондоне были доложены первые результаты наших работ по температурным адаптациям простейших. За истекшие 5 лет коллектив лаборатории продолжал исследования в этом направлении. На ряде видов свободноживущих инфузорий показано, что теплоустойчивость, измеряемая по скорости гибели при летальных высоких температурах, меняется в широких пределах в зависимости от предшествующего температурного режима культивирования. Столь же широкий диапазон изменения теплоустойчивости обнаруживают и паразитические простейшие из пойкилотермных хозяев (изучались паразитические инфузории из амфибий и олигохет и опалинды). Их теплоустойчивость меняется в зависимости от температуры среды, экологических особенностей хозяина и стадий его полового цикла.

Холодоустойчивость инфузорий, также как и способность их переносить глубокое переохлаждение до  $-10-15^{\circ}$  тоже в высокой степени определяется предшествующим температурным режимом. Сравнительный анализ изменений устойчивости простейших к действию летальных высоких и низких температур позволяет предположить, что в основе температурных адаптаций лежат изменения белков цитоплазмы типа обратимой денатурации. Эти изменения связаны с глубокими сдвигами в клеточном метаболизме. На *Paramecium caudatum* показано, что при адаптации к относительно высоким температурам ( $28-29^{\circ}$ ) преобладает окислительный обмен, осуществляемый системой цитохром-оксидазы. При более низких температурах ведущее значение в окислении приобретают флавиновые ферменты. В условиях еще более низких температур ( $4-5^{\circ}$ ) на первое место выступает анаэробный гликолиз. Изменения в характере обмена веществ, происходящие в процессе адаптации простейших к различным температурам, находят свое выражение также в резких изменениях количеств полисахаридов и нейтрального жира, откладывающихся в цитоплазме. Низкие температуры способствуют накоплению указанных веществ.

Широкая способность к индивидуальной адаптивной изменчивости является характерной особенностью простейших, как организмов на клеточном уровне организации.

ANTARCTIC FORAMINIFERAL ZONATION.\* Orville L. Bandy and Ronald J. Echols, Allan Hancock Foundation, University of Southern California, Los Angeles, California.

Bathyal foraminiferal zonation in the Antarctic, based upon upper depth limits of selected indices, is postulated as follows:

- 200<sup>±</sup> 150 M. Adercotryma glomerata Brady  
Alveolophragmium subglobosum (Sars) (Rare)  
Bulimina aculeata d'Orbigny  
Eqgerella bradyi group  
Epistominella exigua (Brady)  
Eponides weddellensis Earland  
Haplophragmoides bradyi (Robertson)
- 500<sup>±</sup> 150 M. Cibicides wuellerstorfi (Schwager) (Rare)  
Cyclammina pusilla Brady  
Haplophragmoides trullisatum (Brady)
- 1,000<sup>±</sup> 200 M. Alveolophragmium subglobosum (Sars) (Abundant)  
Cyclammina orbicularis Brady  
Trochammina globulosa Cushman  
Reophax guttifer Brady
- 2,000<sup>±</sup> 200 M. Astrorhiza crassatina Brady  
Rhabdammina linearis Brady
- 2,400<sup>±</sup> 600 M. Apiopterina extensa (Cushman)  
Bulimina rostrata Brady  
Cibicides wuellerstorfi (Schwager) (Abundant)  
Nonion pompilioides (Fichtel and Moll)  
Uvigerina ampullacea Brady

Isobathyal species of foraminifera are independent of temperature control, they are cosmopolitan, and they are usually dominant at comparable depths in diverse oceanic areas which have severely contrasting temperature profiles. Most of those species listed above are considered to be isobathyal. Heterobathyal species, those occurring in different depths in different oceanic areas, include Eponides tumidulus (Brady), Laticarinina pauperata (Parker and Jones), and Pullenia bulloides (d'Orbigny).

Maximum values for foraminiferal abundance, numbers of species, and planktonic abundance occur in depths of about 400 meters and greater, suggesting increases in these values from inner shelf waters into the bathyal zone. A calcareous benthic foraminiferal fauna exists as deep as 2,400 meters in the Antarctic, indicating that effective lime solution is restricted to depths greater than this.

---

\*Research supported by the U. S. Antarctic Research Program of the National Science Foundation.

ON THE ECOLOGY OF HYDROMEDUSAE. Marta Vannucci, Oceanographic Institute, University of S. Paulo, S. Paulo, Brazil.

The study of the distribution and abundance of the medusae of 247 plankton samples taken at regular intervals at three fixed stations at 25°lat.S. off the Brazilian coast, revealed the presence of 24 species. Seventeen of these were studied in detail and the principal conclusions that may be drawn are: 1 - The following eight species are established as good indicators of the coastal water mass (salinity lower than 35‰ and temperature usually higher than 20°C) in this region: Podocoryne minima, Bougainvillia ramosa, Stomatoca dinema, Laodicea minuscula, Obelia spp., Eucheilota duodecimalis, E. ventricularis and E. paradoxa. 2 - Six species are established as good indicators of the shelf water mass (salinity between 35‰ and 36‰ and temperature not higher than 22°C) in this region: Euphysora gracilis, Eucodonium browni, Turritopsis nutricula, Proboscidactyla ornata and Amphogona apsteini. 3 - One species, Aglaurea hemistoma, is a good indicator of the tropical water mass (salinity higher than 36‰ and high temperature). Two species are ubiquitous. 4 - The distribution in space of the medusae agrees closely with the distribution of the water masses. Frequency/salinity and frequency/temperature curves and frequency/distance-from-the-coastline curves for each species show their distribution in relation to such ecological factors. Salinity/temperature/frequency diagrams show the different behaviour of each species in relation to these two factors when they are considered together. 5 - As a whole these species of medusae are more temperature than salinity tolerant and this is interpreted as being due to the samples coming from shallow waters (depth not beyond 30 metres) and thus there being only species adapted to relatively high temperature shifts. 6 - There are no two species with similar temperature and/or salinity curves for peak of abundance or extremes. Species with similar salinity preferences have different temperature requirements and viceversa. 7 - Plankton is a juvenile type of ecosystem that may be relatively more or less mature. The coastal water mass is subjected to continuous changes and is the most juvenile of all those studied here, while the tropical (Brazil current) is the relatively more mature (old water mass, with smaller variations and longer periods of variation). The shelf water mass is intermediate between the two. 8 - Species or life stages occupying a high trophic level in a juvenile ecosystem cannot reach a high degree of independence and efficiency and thus either leave the plankton or do not reach higher levels. 9 - There are suggestions that some species tolerate lower than optimum salinity conditions better under lower temperature and viceversa higher than optimum salinity facilitates survival under higher temperature (or viceversa). 10 - Better endurance of a wider range of certain factors (salinity, temperature etc.) under laboratory conditions of plankton animals, is explained by inter- and intraspecific competition in the natural environment, as well as the disfavoured factor of sudden changes as compared with protection from competitors under stable laboratory conditions as well as best possible conditions of every ecological factor under control except for the one factor experimented upon. 11 - The shelf water mass species were much richer in number of specimens. This suggests higher standing stock in the shelf water mass.

THE ECOLOGY OF CO-OCCURRING CONGENERIC PINWORMS IN THE  
TORTOISE, TESTUDO GRAECA. G. A. Schad, Institute of  
Parasitology, McGill University, Macdonald College P.O., P.Q.,  
Canada.

Pinworms of the genus Tachygonetria occur in the colon of Testudo graeca in heavy, concurrent, multispecific infections. Ten tortoises examined all harboured a minimum of eight species, six of which occurred in all ten hosts. Adult female worms averaged 2,400, or 18.5 worms/mm of colon. While interspecific differences in linear distribution were found, most species overlapped greatly. In radial distribution eight species were clearly separable into two groups, one group of four species being restricted to a paramucosal distribution; the other group occurred throughout the lumen.

Qualitative food differences and differences in the particle size ingested were shown by a comparative study of the food of eight species of the pinworm. The absence of particulate matter in over half the individuals of one species suggested that it feeds on liquids.

Mycotic and other hyperparasitic infections, due to interspecific differences in susceptibility, may affect the relative abundance of species.

Distributions of species-abundance were calculated from MacArthur's formula based on the hypothesis that a natural community is constituted of species whose ecological niches are non-overlapping and continuous (MacArthur, 1960 American Naturalist 94:25-36). The observed and the calculated distributions of species-abundance for Tachygonetria in individual tortoises differed markedly, and continued to do so when the data from all ten tortoises were pooled. But, the observed and the calculated distributions corresponded closely when the observed abundances were averaged and the species were divided into two groups on the basis of radial distribution (paramucosal vs. throughout lumen). This suggests that the pinworm fauna of the colon of T. graeca should, in fact, be considered as two communities, each constituted of species whose ecological niches are non-overlapping.

ÉCOLOGIE DES SEDIMENTS MEUBLES INTERTIDIAUX, PEUPELEMENTS EN MICROFAUNE & MACROFAUNE. - J. Renaud-Debyser, Lab. Anatomie & Histologie comparées Faculté Sciences & B. Salvat, Museum National Histoire Naturelle. PARIS.

L'étude qualitative et quantitative de la microfaune et de la macrofaune contenues dans un même volume de sédiment permet de faire avancer nos connaissances sur l'écologie des sédiments meubles intertidaux et sur la biologie des diverses espèces, leur interaction et leur compétition sur le plan nutritif.

Plusieurs stations des environs de Wimereux (Manche) et d'Arcachon (Atlantique), de modes, de niveaux et aux conditions de milieu différents ont été prospectées. L'étude écologique a été établie d'après les données physico-chimiques suivantes : salinité, température, granulométrie, porosités, carbonates, matière organique, oxygène dissous et pH. Certains recensements portent sur un nombre atteignant parfois 50.000 individus pour 16 dm<sup>3</sup> de sable. Tous les groupes suivants ont été dénombrés et la plupart ont fait l'objet de déterminations d'espèces : Hydraires, Turbellariés, Nématodes, Gastrotriches, Echinodermes, Archiannelles, Polychètes, Oligochètes, Gastropodes, Bivalves, Acariens, Ostracodes, Copépodes Harpacticides, Tanaïdés, Isopodes, Amphipodes, Insectes. Les Bactéries et les Protozoaires n'ont pas fait l'objet de comptages mais leur masse a été intégrée dans l'évaluation de la teneur en matière organique du sédiment.

Du point de vue qualitatif les listes de faune ont été dressées pour chaque station (neuf stations prospectées).

Envisageant les données faunistiques sous l'angle quantitatif, les auteurs ont été amenés à les exprimer en "biovolumes", qui se sont révélés extrêmement fructueux pour apprécier l'influence de trois grands facteurs écologiques sur les peuplements, à savoir : le mode, le niveau et la salinité. En ce qui concerne le mode, son influence est inverse quant à la richesse en microfaune d'une part et en macrofaune d'autre part : la "Bathyporeia-Haustorius-Zone", par exemple recèle une faune interstitielle bien plus abondante en mode semi-abrité qu'en mode battu, alors que c'est l'inverse pour la macrofaune (Malacostracés en particulier). Néanmoins quelle que soit la densité de population, les faciès semi-abrités sont colonisés par un plus grand nombre de familles et d'espèces, que les faciès battus. En ce qui concerne le niveau, l'abondance des éléments fins du sédiment, révélés par la courbe en nombre de grains, et des débris organiques constituent les deux caractéristiques physico-chimiques prépondérantes dans le contexte écologique des bas niveaux des estrans semi-abrités. Ces facteurs ont une action inverse sur les densités en microfaune et macrofaune : les éléments fins diminuant l'espace habitable, limitent la microfaune, et les débris organiques déterminent la présence d'une abondante macrofaune. L'arrivée d'une nappe d'eau douce continentale en résurgence dans un estran perturbe considérablement l'équilibre qualitatif et quantitatif habituel de la faune, son étude permet de préciser la distribution et la zonation de nombreuses espèces selon la concentration en sels.

Enfin l'étude des biovolumes et de la teneur en matière organique du sédiment ont permis d'établir les chaînes alimentaires rendant effectivement compte de l'équilibre et de la compétition biocénotique.

**ПОЧВЕННАЯ ЭРОЗИЯ И ЕЕ ВЛИЯНИЕ НА ДОЖДЕВЫХ ЧЕРВЕЙ**  
 ( Lumbricidae ) В ЛИТОВСКОЙ ССР. О.П. Атлавините  
и А.И. Паярскайте. Институт зоологии и паразитологии  
и Литовский научно-исследовательский институт земле-  
делия, СССР.

Под влиянием эрозии на отдельных частях склона с уклоном 6-7° создается неодинаковая численность дождевых червей. На верхней, наиболее сильно смытой части склона, количество червей в I, 5-8 раза меньше, чем на средней.

На количество червей большое влияние оказывает способ использования почвы и растительности. Наименьшая численность червей установлена в черном пару, большая - под посевами, самая высокая - на целине и под многолетними травами.

Почвенная эрозия наиболее сильно проявляется весной во время снеготаяния и летом - во время сильных дождей, а смыв червей происходит в течение вегетационного периода во время сильных дождей.

На интенсивность эрозийных процессов имеет влияние количество осадков, их интенсивность и вид сельскохозяйственной культуры, тогда как количество смытых червей не является пропорциональным количеству стекающей воды, ни смываемой почвы, ни общему количеству червей на данной площади.

Интенсивность смыва червей зависит от всего комплекса природных условий и от биологических свойств самих червей.

Максимальный смыв дождевых червей бывает после повторных дождей даже в тех случаях если повторный дождь бывает менее интенсивным и количество смытой почвы меньше, чем в первый дождь.

Более значительный снос дождевых червей бывает в начале и в конце лета.



THE EFFECT OF SALINITY ON THE TEMPERATURE TOLERANCE OF EGGS AND LARVAE OF SOME LAMELLIBRANCH MOLLUSKS. Harry C. Davis, U.S. Bureau of Commercial Fisheries Biological Laboratory, Milford, Connecticut.

Much of the work on tolerances of lamellibranch eggs and larvae to environmental factors has involved only one variable. A study of the effect of temperature on the survival and growth of larvae of the hard clam (Mercenaria mercenaria) and American oyster (Crassostrea virginica) has shown, however, that the rate of growth of these larvae at different temperatures was critically affected by the type of food organisms available. Both clam and oyster larvae were able to utilize naked chrysophytes, such as Monochrysis lutheri, Isochrysis galbana and Dicrateria sp., and show significant growth, at lower temperatures than those at which chlorophytes, such as Chlorella sp., which have cell walls, could be utilized. This implies that the enzyme systems required to digest naked flagellates are active at lower temperatures than are the enzyme systems required to digest cell walls.

It is known that the cells of I. galbana and M. lutheri are destroyed by temperatures of 27.5°C. to 30°C. and growth of larvae receiving these foods at such temperatures is, therefore, reduced. Chlorella sp. can tolerate temperatures of 33°C. and the rate of growth of larvae receiving Chlorella sp. continues to increase with each 2.5°C. increase in temperature up to 33°C.

The temperature tolerance of clam and oyster larvae is also significantly affected by salinity. At near optimum salinities these larvae survive and grow over a significantly wider range of temperatures than at salinities near the lower limits of their tolerance. In this series of experiments we have determined the temperature tolerances of clam and oyster larvae at a series of decreased salinities.

REPRODUCTION AND LARVAL DEVELOPMENT OF THE NEW ENGLAND CLAM DRILL, *POLINICES DUPLICATUS* (SAY) (NATICIDAE: GASTRO-PODA). Dr. James E. Hanks, Director, Bureau of Commercial Fisheries Biological Laboratory, Milford, Connecticut.

Field observations and laboratory experiments indicate that while the breeding season of *P. duplicatus* in the vicinity of Woods Hole, Massachusetts is from June to September, when the temperature of the sea water is above 17°C., the gonads of this species contain ova and spermatozoa throughout the year. Drills moved gradually from water at temperatures as low as 2°C. to 20°C. mate after 1 to 2 days and females produce a nidus (egg collar) within 10 to 12 days. The average number of fertilized eggs within a nidus is 5600, each enclosed by a gelatinous capsule.

At a water temperature between 18°C. and 20°C. cleavage of the egg to the 16-cell stage is completed at 12 to 13 hours and development to a ciliated trochophore stage is reached by 26 hours. Within 2 to 3 days an early veliger stage is attained and larvae are released from the nidus at 10 to 12 days. After about 25 days at pelagic existence, during which the larvae feed on phytoplankton algae, a well-developed foot is present (the pedoveliger stage) and the larvae metamorphose at about 30 days. Recently metamorphosed drills measure 0.5 to 0.7 mm. (shell height) and are carnivorous, feeding mainly on tiny gastropod and pelecypod mollusks.

ZUR UMWELTABHÄNGIGKEIT DES HOLZ-AMPHIPODEN CHELURA TEREBRANS PHILIPPI (AMPHIPODA, CHELURIDAE). Helmut Kühne, Bundesanstalt für Materialprüfung, Fachgruppe "Biologische Materialprüfung, Holzschutz und Holztechnologie", Berlin-Dahlem, Deutschland.

Der Holz-Amphipode *Chelura terebrans* Philippi ist weltweit verbreitet und kommt gebietsweise sehr zahlreich in Holz im Meerwasser vor. Er ist immer mit Holzbohrasseln der Gattung *Limnoria* vergesellschaftet.

Lebensdauer, Postembryonalentwicklung und Vermehrung des Holz-Amphipoden wurden in Abhängigkeit von biotischen Umweltfaktoren (Vergesellschaftung mit *Limnoria*, Ernährung) und abiotischen Umweltfaktoren (Temperatur, Salinität, Sauerstoffgehalt, pH-Wert) im Laboratorium untersucht.

*C. terebrans* ist ein Holz- und Kotfresser. Sowohl der eigene Kot als auch der von *Limnoria* wird gefressen. *C. terebrans* ist daher nicht nur - wie bisher vermutet - auf die von *Limnoria* geschaffenen Unterschlupfmöglichkeiten, sondern auch auf den Kot der Holzbohrasseln angewiesen. Bis zu 2/3 der bei Reinzucht als Holz benötigten Nahrungsmenge können bei Vergesellschaftung in Form von *Limnoria*-Kot aufgenommen werden. Junge Cheluren sind von *Limnoria* abhängiger als adulte. Daher halten sich Laborzuchten ohne *Limnoria* nur etwa über ein Lebensalter von *C. terebrans* (2---3 Jahre bei  $\approx 20^{\circ}\text{C}$ ).

*C. terebrans* ist gegenüber Änderungen der abiotischen Umweltfaktoren empfindlicher als *Limnoria*. Optimaltemperatur und -salinität liegen bei  $20^{\circ}\text{C}$  und 30---35 ‰. Als Grenzwerte, bei denen Fortpflanzung und Entwicklung noch stattfinden können, sind 12---14 und  $26^{\circ}\text{C}$  bzw. 25 und 40---45 ‰ anzusehen. Bei einem relativen Sauerstoffgehalt von 60---65 % ( $26^{\circ}\text{C}$ ) sind Eiablage und Postembryonalentwicklung noch möglich. Ein Sauerstoffgehalt unter 5 % läßt die Tiere innerhalb von 2 Tagen ersticken (bei  $22^{\circ}\text{C}$ ). Der Lebensablauf ist normal bei pH-Werten zwischen 6---7 und 9.

ИЗМЕНЕНИЯ ЭНТОМОФАУНЫ ПРИ ОСВОЕНИИ ПОЛУПУСТЫНЬ СРЕДНЕЙ АЗИИ (на примере Голодной степи). В.В. Яхонтов, Институт зоологии, Ташкент, СССР.

Энтомофауна Голодной степи (Узбекистан) довольно богата и разнообразна; доминируют чернотелки, долгоносики и пластинчатоусые, затем по численности идут цикадовые и саранчовые.

Энтомофауна различных целинных биотопов неодинакова. Наиболее разнообразна и богата фауна прибрежных участков (тугаев), наиболее бедна энтомофауна засоленных участков. Видовой состав насекомых на целинных землях, исключая засоленные участки, много богаче чем на освоенных под посевы территориях, но популяции отдельных видов на полях многочисленнее.

Наибольшее разнообразие и численность имагинальных форм весной, минимально в середине лета и снова нарастает к осени.

Весной большинство насекомых активно в середине дня, а в июле-августе — ранним утром и вечером.

С распашкой и орошением земель и с освоением их под посевы некоторые виды насекомых уже в первый же год исчезают (*Acanthotermes turkestanicus* Jacobs., *Arenivaga roseni* Br., *Copris lunaris* L. и др.).

С первых лет освоения земель резко нарастает численность некоторых олигофагов способных питаться на культурных растениях (*Thrips tabaci* Lind., *Aphis medicaginis* Kalt., *Therioaphis ononidis* Kalt., *Adelphocoris lineolatus* Goeze, *Lygus pratensis* L. и др.).

Освоение целины ведет к процветанию *Psammotettix alien-sis* Dnb., *Platymetopius turkestanicus* Kuz. и др.

Из полевых угодий наиболее богата фауна люцерны — уже в первые годы после посева до 40 видов насекомых.

TEMPERATURE ADAPTATION OF DROSOPHILA. Alice S. Hunter, Dept. of Biology, University of the Andes, Bogotá, Colombia.

Studies of seasonal frequency and geographic distribution of species of *Drosophila* show that some species are found over a broad range of temperature while others are more limited. Those which are distributed widely relative to environmental temperature may be considered eurythermal, while others more restricted could be called stenothermal. The data reported here are the first part of a large study comparing the metabolism of stenothermal and eurythermal species of *Drosophila*.

The respiration of *D. melanogaster* chosen as an example of a eurythermal species has been measured at 15°, 20°, 25° and 30°C. The adult flies used in these experiments were grown at 15°, 25° and 30°C. during many generations after cultivation from the original stock collected in Bogotá, Colombia (altitude of 2,650 meters, average temperature 15°C.). Two stocks which differ in the number of adults put in to lay eggs, were maintained at 15° and also at 25°C. The measurements of oxygen consumption were taken in the Warburg on 25° and 30° flies of 1-3 days since hatching and on 15° flies of 4-10 days age. The results are reported in microliters oxygen consumed per fly and also per milligram wet weight of fly per hour.

Comparing flies grown at 15° with those grown at 25°C. a significant difference in the oxygen consumption per milligram of females is found at 20°C. Calculations of  $Q_{10}$  give a lower value at higher temperatures. The data are in agreement with the theory that some temperature acclimation takes place in the metabolism of the eurythermal species, *D. melanogaster*.

ECOLOGICAL STUDIES OF CERTAIN NEOTROPICAL DROSOPHILIDAE.

S.B. Pipkin, The Gorgas Memorial Laboratory, Panama, Republic of Panama, and R.L. Rodríguez, The University of Costa Rica, San José, Costa Rica.

Drosophilidae of forests near Panama City include adult feeders on micro-organisms growing upon a variety of fallen fruits and blossoms, (2) living flowers, and (3) fungi (not further discussed). As larvae the first group uses not only fallen plant parts but also invades various living plant species in several sites without much plant host specificity. In contrast, each flower-feeding species confines its larval stages to flowers of one or a few plant host species. The ground-feeding Drosophilidae of the first group comprise (1) thirty-one species never entering traps baited with cultivated fruits, (2) thirty-three species attracted to such traps. Of the trap-entering flies, twenty species come to traps which are seldom found with the trap-refusers in natural populations. Thirteen species both enter traps regularly and are also found in natural populations with trap-refusers. Sixty per cent of the trap-refusers plus the thirteen species both entering traps and feeding with trap-refusers belong to the *Drosophila tripunctata* species group.

Within the forests of the two major collection areas at Barro Colorado Island and Cerro Campana, respectively, there are local but only slight seasonal fluctuations for ground-feeders, owing to the abundance of food and rather constant climatic conditions. At a mountain station located on cleared land a hundred yards from the forest, indigenous forest species were absent from the traps only during the dry windy season, large populations of three cosmopolitan species developing here at this time. Definite seasonal fluctuations occur for certain flower-feeding forest species with a limited number of plant hosts, the population peak of the fly species corresponding to the height of the blossoming of its respective plant host species. Net sweeping for no more than an hour over a single micropopulation, feeding on the fruit of a single tree, shrub, or vine, catches usually less than six and rarely more than forty individuals of a single trap-refusing species. The thirteen species feeding with the trap-refusers but which also regularly enter traps build larger populations. Cosmopolitan species in the forests are found in low numbers, comparable to those of native species. Each of five pairs of sibling species has proven ecologically sympatric in larval development by hatching simultaneously from the same respective plant tissues.

This research has been supported by NSF Grant 16028 and PHS Grant RG 6813.

POPULATION ENERGETICS OF MEADOW SPITTLEBUGS (*PHILAENUS SPUMARIUS* L.) AS AFFECTED BY MIGRATION AND HABITAT. Richard G. Wiegert, Lab. of Radiation Ecology, Univ. of Georgia, Athens, U. S. A.

The population of adult meadow spittlebugs on an abandoned field in southeastern Michigan is maintained by large scale movements of the insects out of nearby legume hayfields during mowing. The majority of these immigrants die on the old field. This one-way movement of energy has important consequences for the energetics of the old field community.

In 1960 mortality on the old field amounted to 1138 gcal/m<sup>2</sup> and the total ingestion was 2010 gcal/m<sup>2</sup>. This gave a gross efficiency of yield (57%) more than threefold greater than the maximum possible value for this species when the immigration/emigration rates are equal. Because of the quantitative importance of spittlebugs in the old field insect fauna, this large input of energy due to immigration could be maintaining predator or scavenger populations at much higher levels than they would attain in the absence of the immigrants.

The population density of spittlebugs on an unmowed hayfield was higher, and the nymph mortality lower than on the old field. Annual population energy flow on this hayfield in 1960 was 38.5 kcal/m<sup>2</sup> versus 1.2 kcal/m<sup>2</sup> on the old field. Seasonal changes in the population energy flow of the nymphs were similar on the two habitats. The changes in energy flow after the disappearance of the nymphs differed between habitats because of the difference in origin and subsequent behavior of the adult populations.

THE DEPENDENCE OF PRODUCTIVITY ON THE SIZE OF MEDIUM  
IN SELF-RANGING, CONFINED POPULATIONS OF PARAMECIUM,  
TRIBOLIUM AND MUS. Kazimierz Petruszewicz,  
Inst. Ecology, Pol. Ac. Sci., Warsaw, Poland.

The populations were reared in habitat conditions as far as possible identical for the given species, with a constant abundance of food. Only the size of the habitat was a variable parameter.

Paramecium was cultured in (1) vessels of a constant shape and (2) with a constant ratio of the surface (free and walls) to the volume of the habitat.

The mean numbers and density for the whole period were calculated for all the repeats for the whole period. By density is meant the number of individuals of: mice per 1 sq.m.; Tribolium per 1 g of flour, and Paramecium - per 1 ml. Calculation was also made of relative density, i.e. density expressed in percentage of density with minimum volume (1x). Results:

Popula- tion of:	Mus	T. cas- taneum	T. con- fusum	Paramecium, const. vials:	
				shape	surface volume
replica- tions	4-61	15	15	10	10
time (mean)	22 months	12 months		36 days	
size of medium	1x = .057 m <sup>2</sup>	1x = 4g		1x = 100 ml	
1x	212 = =100%	21 = =100	28 = =100	1191 = =100	857 ± =100
2x	66	92	72	83	-
4x	35	72	59	65	80
8x	-	59	41	56	-
11x	23	-	-	-	-
16x	-	51	35	33	71
22x	12	-	-	-	-
105x	7	-	-	-	-

Analysis of the results shows that in all the populations: (1) Population numbers increase with an increase in the size of the medium, but (2) increase in population numbers is smaller than increase in the size of the medium, hence (3) density decreases with the increase in the size of the medium.

The mean abundance is a certain expression of productivity; in self-ranging, confined population of very different organisms we have the same regularity: productivity is greater higher in a habitat of lesser size.



FIRST BENTHIC STUDIES IN "FLAMENGO" BAY. Liliana Forneris, Instituto Oceanográfico, University of São Paulo, São Paulo, Brazil.

Bottom faunal studies were undertaken on soft bottom sediments dredged at six points (depth range: 1 - 32 m) in "Flamengo" Bay, northern coast of the State of S. Paulo, Brazil. The work was started in July 1961 and finished in July 1962, covering four seasons sampling at each point. Difficulties to establish a rigid community classification based on the nature of the sediment or depth were due to the great diversity of the fauna and the scarcity of animal numbers present. Numbers varied from 110 ind/m<sup>2</sup> (32 m depth; mud) to an average of 2,700 ind/m<sup>2</sup> (3 m depth; muddy sand with rare shells). In mud with dead shells (higher than 50% of silt-clay of total sediment) only the polychaete species Scoloplos treadwelli and Dasybranchus sp. occurred (minimum one ind/two liters). Clusters of some species were recognized: the bryozoan Discoporella umbellata (60-80% of silt-clay in total sediment; 6-12 m depth; maximum circa of 30 ind/liter). The polychaetes: Owenia fusiformis, Magelona rosea, Pectinaria koreni, Myriochele sp. and the prosobranch Alabina cerithioides showed euryoecia in relation to sediment type. Protankyra benedeni (Holothuroidea), the spatangid Moira atropos, the polychaetes Chaetosone setosa, Glycera sp., the sipunculid Phascolosoma sp. and the enteropneust Schizocardium braziliensis are sthenoeccious. The ophiurids Hemipholis elongata, Amphipholis subtilis, Amphiodia limbata, the polychaetes Telepsavus costarum, Pectinaria koreni, are eurybaths. Gravel and sandy sediments of shallow waters are characterized by Branchiostoma sp., Ampelisca sp., Chaetosone setosa, Glycera sp., Lumbrineris sp., Phascolosoma sp., Ophiostigma isacanthum, Dentalium texasianum, Chione cancellata etc. Seasonal displacements of species were noticed.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

9B. ECOLOGY

SOIL MITES, EQUIVALENT FOR THE NORTHERN AND SOUTHERN HEMISPHERES;  
John Balogh, Dept. of Syst. Zoology, Eötvös University, Budapest  
8, Puskin 3, Hungary.

The study of soil mites advanced rapidly in recent years. This progress, aside of the scientific interest, derived also from three practical points of view. It was found, namely, that

1. there are vectors of virus diseases among soil mites /e. g., Trombiculid larvae/;
2. several species are intermediate hosts for worm parasites of domestic animals /Oribatid mites/;
3. several species play, directly or indirectly, important roles in humification.

Investigations had also shown that mites important from the standpoint of applied sciences are mostly common species of great individual numbers.

It is a well-known fact of zoogeography, that, in the biotic communities of remote areas of similar climates, species sometimes systematically widely separated supplant each other. Such, structurally different but functionally agreeing, biotic communities are called isocoenoses. The soil animal communities of the climatically equivalent vegetational zones of the northern and southern hemispheres might belong to the same isocoenoses. E. g., the family Parasitidae of the Mesostigmatid mites, characterized by great specific and individual numbers in the Holarctic Region, is wholly suppressed in the Southern Hemisphere, its place taken over by the large-sized species of the family Rhodacaridae /Hydrogamasus, Gamasellus/. Several other examples occur in other soil mite groups.

Special attention should be paid, warranted by the applied standpoint, to these equivalent soil mites of great individual numbers. In accordance with the principle of functional agreement, it is quite probable that they substitute also as vectors and intermediate hosts Holarctic species absent from the Southern Hemisphere. Secondary soil mite faunas, appearing on areas recently drawn under cultivation are also important, since only by some few species of a high ecological valency can tolerate continuous disturbing due to agriculture. Thus agriculture wellnigh selects these species in every climatal zone. Such are, in the temperate zone, Scheloribates species, replaced by Rostrozetes species in tropical and subtropical areas.

It is especially important from the applied point of view to study the problem of functional equivalency for tropical soils. Tropic soil zoology lags alarmingly behind in every part of the world. This backwardness is partly responsible for the rapid increase of the soil-erosion of tropical plantations, and for pest-control becoming increasingly difficult despite the fast advancement of plant protection. Though the work of the soil zoologist cannot render immediate help, it is indispensable for every effective solution of these problems.

RESPIRATORY METABOLISM OF LEIOBUNUM ROTUNDUM (LATR.)  
(PHALANGIIDA). John Phillipson, Dept of Zoology,  
University of Durham, England.

For a number of years the author has studied various British Phalangiida with the aim of determining their respiratory metabolism and thus estimating the share of entire populations in community metabolism.

The present paper is concerned with the respiratory metabolism of Leiobunum rotundum. Members of this species were, within one hour of collection, subjected to oxygen consumption experiments in a continuously recording respirometer. All stages of the life history were studied and the respiratory rate was calculated for the 24 h. period between 6 and 30 h. after the experiment began.

The instars of L. rotundum cannot yet be separated and so the results obtained were expressed in a number of different ways:-

1. The raw data was plotted as  $\text{mm}^3\text{O}_2/\text{mg/h.}$  against live weight. Using biomass figures it was calculated that the mean respiratory metabolism per sq.m. per h. equalled  $32.60 \text{ mm}^3\text{O}_2$ .
2. A log. log. plot of the oxygen consumption per h. against live wt. was made. With the biomass figures as before, mean respiratory metabolism equalled  $23.15 \text{ mm}^3\text{O}_2/\text{sq.m./h.}$
3. The results were grouped according to the month in which the experiment was made and the mean value for each month expressed as  $\text{mm}^3\text{O}_2/\text{mg/h.}$  Mean respiratory metabolism was equivalent to  $28.41 \text{ mm}^3\text{O}_2/\text{sq.m./h.}$
4. The results were grouped according to the state of the gonad (small, developing and ripe eggs) and age; mean values were expressed as  $\text{mm}^3\text{O}_2/\text{mg/h.}$  In this case mean respiratory metabolism equalled  $39.45 \text{ mm}^3\text{O}_2/\text{sq.m./h.}$

The minimum and maximum estimates of respiratory metabolism are in the ratio of approximately 1:1.75. Clearly care must be exercised in handling respiration data in the estimation of the respiratory metabolism of populations. It is suggested that the most reliable estimates are obtained from those results which are grouped according to gonad condition and age.

TEMPERATURE RESPONSES OF THE PARASITOID, PRAON PALITANS, AND ITS  
 APHID HOST, THERIOAPHIS MACULATA. P. S. Messenger and D. C.  
Force, Division of Biological Control, University of California,  
Albany, California.

By means of bioclimatic chambers and constant temperature incubators the relationships of fluctuating and constant temperatures to developmental rates, reproductive rates, and survival of the arrhenotokous solitary endoparasite, Praon palitans, and its host, the parthenogenetic Therioaphis maculata, were determined. For both species, fluctuating temperatures stimulate faster development and greater reproduction than do the corresponding constant conditions. Low thermal levels induce a diapause in the parasitoid, but not in the host. Both high and low thermal levels cause the production of abnormally high numbers of males in the braconid parasitoid. Low temperatures also cause the latter to waste a large proportion of eggs in superparasitism, essentially because of restricted mobility of the searching female wasp.

The results show that the aphid host has a much wider tolerance to temperature extremes than the parasitoid. The intrinsic rate of population increase of the former is positive between 5° and 33° C., of the latter only between 12° and 28° C. On the basis of this same bioclimatic index, the optimal temperature for the host is 30° C., while for the parasitoid it is only 21° C. These results are correlated closely with the actual geographic ranges of these species in California.

PREDATORY INSECTS AS DENSITY DEPENDENT MORTALITY FACTORS  
G. C. Varley and G. R. Gradwell  
Hope Department of Entomology, Oxford University, Oxford, England

In a detailed census of the winter moth *Operophtera brumata* changes in population and in various components of the mortality have been estimated since 1949 on five adjacent oak trees in a large wood. Pupal mortality partially compensates for changes in the pupal population (Varley & Gradwell 1960, *J. anim. Ecol.*, 29 : 399-401). This mortality has multiple causes which we cannot separately assess. Moles, mice and predatory beetles (*Feronia*, *Abax*) play a part, but experiments show that Staphylinid larvae (*Philonthus decorus*) are especially important. Even small larvae quickly open cocoons and eat winter moth pupae.

Predators show a functional response (Holling 1959, *Canad. Ent.*, 91 : 385-98) if local concentrations of prey are more heavily attacked than prey which is dispersed. Their effect on the prey is density dependent. Predators show a numerical response if their effective reproductive rate rises with increasing prey density. They affect the prey as delayed density dependent mortality factors (Varley 1947, *J. anim. Ecol.*, 16 : 140).

The mortality of winter moth pupae has been tested for density dependency by two methods:

Method 1: A linear regression was calculated from the formula  $\log(\text{survival}) = \log N_2 - \log N_1 = a - b \log N_1$  where  $N_1$  and  $N_2$  are the initial and final pupal densities and  $a$  is a constant. Here  $a = 0$ . The calculated slope  $b = 0.35$  differed significantly from zero ( $P < 0.01$ ). Strictly the standard test of significance is invalid because any error in  $N_1$  accentuates the apparent density dependency.

Method 2 avoids this criticism. We calculated the regression of  $\log N_2$  on  $\log N_1$  and found a significant divergence of the slope from 1 ( $P < 0.005$ ). Since the method implies that  $N_1$  was accurately known, the regression of  $\log N_1$  on  $\log N_2$  was similarly tested ( $P = 0.05$ ). This confirms the reality of the density dependency and we have studied the properties of pupal predation in a series of population models programmed for a Mercury computer. The population models include three components: (i) a host with a fixed effective rate of increase of 7.5-fold per generation (the mean figure for winter moth) (ii) a parasite with a fixed area of discovery of 0.063 sq.m. (the estimated figure for the specific tachinid parasite *Cyzenis albicans*) and (iii) density dependent predation according to the form of the regression but with slopes of  $b = 0.2, 0.3, 0.4$  and  $0.5$ . With a slope of  $0.2$  Nicholsonian parasite/host oscillations increase. With a slope of  $0.3$  oscillations slowly diminish. A value of  $0.4$  damps them rapidly and reduces the parasite population density. At a value of  $0.5$  the host population is stable but the parasite becomes extinct. Our estimate for the slope  $b = 0.35$  of the pupal predation regression suggests that pupal predation prevents parasite/host oscillations from increasing in amplitude.

A test for a numerical response is to join the individual points on a graph of Method 1 in a time series. The line moves round the mean point in a flat ellipse. If predation gives a purely numerical response (Varley 1953, *IX Int. Congr. Ent.*, 2 : 210-14) a circle or spiral results. The delay component in pupal predation is very weak compared to this but must reinforce any tendency towards parasite/host oscillations.

LES CARACTERES "MIMETIQUES" AU SERVICE DE LA PROTECTION CONTRE LES RADIATIONS SOLAIRES NOCIVES CHEZ CERTAINS INSECTES ET CHEZ D'AUTRES ESPECES ANIMALES. Lazar Jovančić, Institut de Physiologie, Université de Belgrade, Yougoslavie.

De nouvelles preuves expérimentales sont données que la formation des pigments tégumentaires chez les espèces animales terrestres vivant dans les endroits découverts dépend uniquement de la combinaison de trois facteurs externes: lumière, température, humidité relative, la couleur du substratum ne jouant aucun rôle. - De jeunes larves vertes de Mantis religiosa ont été élevées sur des substratums de couleur différente: verte, jaune, bleue et rouge, mais sous l'action presque constante de lumière blanche (ampoule électrique de 60W), température 35-38°C, humidité relative 41-43%. Toutes les larves perdaient leur couleur verte et devenaient adultes de couleur beige. Puis des expériences semblables ont été exécutées avec Hyla arborea. Plusieurs exemplaires ont été soumis à l'action directe d'un soleil ardent (34-36°C) et dans une atmosphère très sèche (h.r. 40% et moins). En quelques heures tous perdaient leur couleur verte intense en devenant brun-clair ou grisâtres, même au milieu d'une couche de feuilles vertes fraîches. Ces résultats appuient encore mon hypothèse émise en 1953 (Bull. biol. Fr. Belg.) et en 1960 (thèse, Mus. Sci. Nat. Belgrade) que les pigments tégumentaires chez les espèces vivant dans des terrains découverts jouent un rôle purement physiologique, protégeant l'animal contre les radiations solaires nocives: ultraviolettes (milieu humide, température modérée) et infrarouges (milieu sec et chaud). - Une autre série d'expériences avec les larves d'âge avancé de Bacillus Rossi, Empusa egea et Gryllus campestris avait pour but d'étudier le comportement de ces espèces soumises à l'action d'une température élevée allant jusqu'à 45°C. Il a été établi que Bacillus Rossi et Empusa egea résistaient beaucoup mieux à de hautes températures que Gryllus campestris. En analysant la morphologie du corps de ces deux premières espèces on aperçoit qu'elle est très spéciale et en rapport étroit avec la protection contre l'action des rayons solaires chauds auxquels elles sont continuellement exposées. On en conclue que la "homotypie" de ces deux espèces est, en fait, aussi au service de la protection contre les rayons solaires nocifs. Comme il existe des plantes xerophiles avec une morphologie spéciale leur permettant de subsister dans des endroits chauds et secs, de même il y a des animaux xerophiles avec des adaptations morphologiques ayant la même fonction.

QUALITY OF THE SPAWNING BED AS IT RELATES TO SURVIVAL AND GROWTH  
OF PINK SALMON EMBRYOS AND ALEVINS AND TIME OF FRY EMERGENCE.  
William J. McNeil, Fishery Research Biologist, U. S. Bureau of  
Commercial Fisheries, Biological Laboratory, Auke Bay, Alaska

Growth, development, and survival of embryos and alevins of salmonid fishes are affected by the availability of dissolved oxygen in spawning beds. The oxygen supply rate to an embryo or alevin is a function of dissolved oxygen content and apparent velocity of intragravel water.

Oxidizing organic detritus, interchange between stream and intragravel water, and permeability of bottom materials exert a significant influence on the amount of oxygen made available to embryos and alevins. Growth and survival of pink salmon (*Oncorhynchus gorbuscha*) embryos and alevins in a small South-eastern Alaska stream were found to be related to these environmental attributes. Evidence was also obtained that fry emergence was delayed where environmental factors were most likely to cause occurrence of oxygen stress during development.



NITROGEN TURN-OVER IN AN ESTUARINE FISH POPULATION. Rezneat  
M. Darnell, Department of Biology, Marquette University,  
Milwaukee, Wisconsin.

This study of the nitrogen turn-over in a population of pinfish (Lagodon rhomboides) in a North Carolina estuary is based upon the following procedure:

- 1) Determination of nitrogen content of fish in relation to body length,
- 2) Laboratory study of growth at different rates of nitrogen intake,
- 3) Study of growth rates in the natural population,
- 4) Estimation of the natural daily food intake (average daily meal) at intervals during the growth period, and
- 5) Analysis of the nitrogen content of the several average daily meals.

The critical and difficult part of this study has been the estimation of daily meals in the natural population. This has been accomplished as follows:

- 1) Laboratory analysis of factors influencing the rate of food movement through the stomach,
- 2) Quantitative stomach analyses of fish collected at 2-hour intervals throughout the 24-hour periods and preserved immediately upon collection, and
- 3) Quantitative stomach analyses of fish collected at 2-hour intervals throughout the 24-hour periods but kept in live cages in the estuary (isolated from food) for 2 hours prior to preservation.

Results of the study are discussed in relation to the nitrogen cycle of the estuary.

EXTINCT, RARE, AND ENDANGERED AMERICAN FRESHWATER FISHES.  
Robert Rush Miller, Museum of Zoology, The University of  
Michigan, Ann Arbor, Michigan, U.S.A.

Approximately 10 species of freshwater fishes have become extinct in the United States and northern Mexico since the close of the nineteenth century. About 30 additional species are now either rare, of very restricted range, or are threatened with extermination. Reasons for the elimination and decline of freshwater fishes are given and suggestions are made for the preservation of endangered forms.

INFLUENCE OF FRESHWATER ENVIRONMENT ON SURVIVAL OF COHO SALMON. William A. Smoker, Auke Bay Biological Laboratory, Auke Bay, Alaska.

Adult coho salmon, Oncorhynchus kisutch, are caught in their final year of life in certain fisheries in the Northeast Pacific Ocean along the North American Continent. The abundance of salmon in the annual catches is found to fluctuate at times in a similar manner as the amount of water discharged during the juvenile residence of the salmon in their natal freshwater streams. The procedure for measuring salmon abundance and combined stream discharges is described, and the possible reasons for the close correlations are discussed.

THE FATE OF INTRODUCED FRESHWATER FISH IN MALAYA. D.S.  
Johnson and Maureen H.H. Soong, Department of Zoology,  
University of Singapore, Singapore.

Fish have often been successfully introduced to temperate freshwaters. It is of interest to know what happens to fish introduced into areas with richer faunas.

Malaya has about 250 species of freshwater fish. Numerous other species have been introduced. Only 5 are generally established: Puntius semifasciolatus; Lebistes reticulatus; Tilapia mossambica; Trichogaster pectoralis; and Betta splendens. The last may really be native in certain areas. In addition Gambusia affinis and Mollienessia sp. are possibly locally established. No species has successfully invaded natural forest habitats.

Lebistes reticulatus; Gambusia affinis; and Mollienessia sp. are all of New World origin and, significantly, all belong to the viviparous Poeciliidae. Only Lebistes really flourishes. Individuals of Mollienessia and hybrids between this and Lebistes are found in Singapore; but these could represent repeated introductions. Reports in the literature claim that Gambusia was successfully established in Malaya as a mosquito control measure. These are without factual basis, but a small population is surviving in a polluted stream, the S. Whampoa, in Singapore. In this stream the oxygen content never exceeds 54% saturation and may fall as low as 7%. The free ammonia varies between 40 and 60 pts./million, and the alkalinity between 26.1 and 55.2 pts. bicarb. ion/million.

Lebistes occurs in large numbers in much disturbed or highly polluted habitats in and near towns, including ponds, canals, drainage ditches, and monsoon drains. Its success is partly due to its needing no special breeding site and to its high fecundity. It is also due to its ability to withstand conditions which few or no other fish can tolerate. Limits recorded in Malaya are: alkalinity 6 - 175 pts. bicarb. ion/million; oxygen - often in waters with no detectable oxygen; pH 5.2 - 7.6 - the last being a distinctly high pH in Malaya; free ammonia 14 - 397 pts./million ! ; temperature 25.6 - 33.4°C. Determinations for Singapore habitats give ranges for cations of : Ca, .25 - 22.5 pts./million; Na, 2.35 - 35.0 pts./million; K, .8 - 16.5 pts./million. It possibly occurs in higher Ca concentrations elsewhere in Malaya.

Lebistes has not been found in less disturbed and polluted habitats, such as riceland ditches. These usually have a richer native fish fauna.

These data indicate that introduced forms only flourish where they can exploit an unusual habitat not available to the general local fauna. Conditions in these polluted waters approximate to those of natural swamps in semi-tropical areas. With the possible exception of Puntius semifasciolatus, all of these successful, introduced species originate from such habitats.

COMPARATIVE ECOLOGY OF FOUR SYMPATRIC DENDROBATID FROGS IN  
NORTHERN VENEZUELA. Frederick H. Test, Dept. of Zoology,  
The University of Michigan, Ann Arbor, Michigan, U.S.A.

In the vicinity of the Venezuelan Estación Biológica Henri Pittier in the northern coastal mountains occur four species of dendrobatid frogs which belong to two closely related genera or to the same genus. They replace one another ecologically in this area.

Prostherapis trinitatis, the best known, lives close beside the small streams which tumble down the mountains and uses cavities under stones as shelters. Adult females, the slightly larger sex, have an average snout-anus length of about 25 mm. Prostherapis neblina, which is closely similar in form, slightly larger, and a little different in color, occupies the floor of the cloud forest, sheltering in fractured rock outcrops and fallen leaves of palms. The delicate Phyllobates bromelicola has been found only in water-holding bromeliads, both epiphytic and terrestrial, in the cloud forest. Adults reach only 20 mm., are paler than the above species, and have markedly depressed bodies, apparently an adaptation to hiding deep within the spaces between the clasping leaves. Phyllobates brunneus is only a little larger and resembles Prostherapis neblina more closely in form and coloration. It occurs near the Biological Station only in the brush and grass of man-made clearings. However, on a peak with cloud forest 15 km. away, where Prostherapis neblina is absent, Phyllobates brunneus replaces it, occupying the forest floor and using the same kind of shelters.

The evidence indicates that these four species show almost no overlap in microhabitat where they occur in the same region. It is suggested that this may result in part, at least, from an extension of social antagonism, as exhibited in strong intraspecific territoriality (known for Prostherapis trinitatis and P. neblina and probably true of the other species), to interspecific behavior. In contrast, species of the genus Eleutherodactylus, for which no evidence of territorial behavior is known, show considerable ecologic overlap in this region.

## SOME ASPECTS OF THE WATER ECONOMIES OF NINE SPECIES OF AMPHIBIANS

William D. Schmid  
Department of Biology  
University of North Dakota  
Grand Forks, North Dakota

James G. Underhill  
Department of Zoology  
University of Minnesota  
Minneapolis 14, Minnesota

The water economies of nine species of anuran amphibians have been examined in regard to (1) response to desiccation stress, (2) response to hydration stress, and (3) some physiological factors related to the observed interspecies differences in these responses; i.e., effective osmolarity of blood and permeability of skin to water.

The nine species exhibited a marked variation in habitat preference with regard to the availability of water and correlations were observed between habitat and response to experimental conditions. Species from more aquatic habitats exhibited lower tolerance to desiccation stress than species from terrestrial habitats. However the more aquatic species were more tolerant to hydration stress. In addition, correlations were observed between these responses and physiological factors related to water economy: the blood of aquatic species tended to be of lower effective osmolarity and the skin of aquatic species tended to be less permeable to water. The apparent physiological specialization of these nine species to the availability of water in their preferred habitats is discussed.

A SPECTROPHOTOMETRIC ANALYSIS OF COLOR IN LIVING REPTILES. Kenneth S. Norris, Dept. of Zoology, University of California, Los Angeles, West Los Angeles, California.

A recording reflectance spectrophotometer in combination with a temperature-controlled animal holder has been used to study several aspects of living animal color. These include the matching of an animal to its background, color lability as regulated by hormones, temperature or circadian rhythms, and the radiant heat absorption capacity of animal skin.

Background color-matching has been found to be centered almost entirely within the human visible spectrum and to consist of superposition of the reflectance curves of animal and its substratum.

Color lability has been delimited for several species and while it is generally concentrated in the visible spectrum it extends well beyond these limits in some species, into both ultraviolet and infrared regions. A good correlation between high lability and high skin reflectivity is often found. Total radiant heat absorption capacity is found to be correlated with body size or the occurrence of certain heat regulatory features.

TOLERANCIA EN GRUPOS BIESPECIFICOS DE PINNIPEDIOS.  
Raúl Vaz-Ferreira & Blanca Sierra-de-Soriano, Depto.  
de Zoología Vertebrados, Fac. de Humanidades y Cien-  
cias, Montevideo, Uruguay.

Arctocephalus australis Zimmermann y Otaria byronia (de Blainville), en condiciones de concurrencia, presentan en el Uruguay, caracteres diferenciales en los siguientes aspectos:

Topografía de los lugares de cría: A.australis establece los criaderos en lugares escarpados; O.byronia en suelos más llanos.

Locomoción sobre terrenos quebrados: A.australis asciende por rampas más empinadas.

Mecanismos etológicos de regulación térmica: A.australis efectúa sumersiones periódicas en el agua y aprovecha la sombra de las rocas; O.byronia se vierte arena húmeda sobre el dorso mediante las aletas y también regula la irradiación térmica variando las distancias interindividuales.

Períodos de cría: A.australis comienza la cría un mes antes que O.byronia.

Características de las señales sonoras de intercomunicación: entre distintas categorías de individuos se hace para cada especie a diferentes frecuencias.

Configuración de los grupos de cría: en A.australis fragmentarios y extendidos dejando espacios donde se ubican agrupaciones compactas de O.byronia.

Áreas de alimentación: A.australis preferentemente al borde de la plataforma continental; O.byronia preferentemente sobre ésta.

Alimento: la composición cualitativa de la alimentación de cada una de las especies es diferente.

Este tipo de asociación de Otariidae, que se encuentra también en otras áreas geográficas donde se constituye con otras especies, permite a los miembros de esta familia el aprovechamiento máximo de los ambientes terrestres de cría y de los recursos alimenticios de áreas marinas extensas.



**ECOLOGIA DE VERTEBRADOS EN AGUAS DULCES TEMPORALES DEL URUGUAY. Raúl Vaz-Ferreira, Blanca Sierra-de-Soriano & Juan Soriano-Señorans, Deptos.de Zoología Vertebrados y de Geografía Física y Biológica, Fac.de Humanidades y Ciencias, Montevideo, Uruguay.**

Se consideran durante 18 meses, las situaciones, características topográficas, físicas, químicas, y la integración de la fauna de vertebrados, en masas de agua dulce temporales del Uruguay.

Se establecen los siguientes grupos de componentes de la mencionada integración faunística de acuerdo a su forma de duración o de reposición después del período de sequía.

1) Integrantes que permanecen al estado de huevos resistentes depositados a varias profundidades del 11 mo subyacente, en el lecho desecado, se encuentran entre ellos 9 especies del género Cynolebias cuyos huevos embrionados se describen analizándose las condiciones de su medio.

2) Integrantes que habitan en aguas permanentes próximas al charco y que ingresan por confluencia con la masa temporal, habiéndose registrado los siguientes géneros: Cheirodon, Apareiodon, Curimatus, Corydoras, Cnesterodon, Phalloceros, Jennynsia, Pimelodus, Callichthys, y Cichla.

Especies predadoras anfibias o aéreas que se acercan a la comunidad a medida que ésta alcanza un grado trófico adecuado, comprendiendo peces: Synbranchus; batracios: Pseudis y Leptodactylus; reptiles ictiófagos: Platemys y Leimadophis; aves: Ardea, Casmerodius, Leucophoyx, Rostrhamus, Pitangus, etc.

Se estudia la participación de los tres tipos de integrantes y se representa graficamente la composición específica de la fauna de peces de cuatro grupos de charcos.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

CONTRIBUTED PAPERS SESSION

9C. ECOLOGY

SPECIES COMPOSITION AND POPULATIONS OF SEA BIRD COLONIES  
AT CAPE THOMPSON, ALASKA. L. G. Swartz, Biol. Sci. Dept.,  
University of Alaska, College, Alaska, U.S.A.

Ecological studies of sea bird colonies were conducted during the summers of 1959, 1960, and 1961 at Cape Thompson, the northernmost colonies (except for those 40 miles north at Cape Lisburne) on the western coast of North America. Nine species of sea birds breed on the sea cliffs. Abundance of the following was determined by direct counts of nesting sites: Phalacrocorax pelagicus, Larus hyperboreus, Rissa tridactyla, Cephus grylle, C. columba, and Lunda cirrhata. Abundance of Uria aalge and U. lomvia was determined by individual count of the birds and in some cases by estimates. In this region numbers of Uria undergo cyclic daily fluctuations such that the birds counted at a given time do not represent the total population nor a constant fraction thereof. Raw data were adjusted upward to yield the "true breeding population" by techniques which derived the per cent of the true population present at the cliffs at the moment of census. Fratercula corniculata were censused by counts of the birds and by locating the nesting sites.

Results:	1959 <sup>a</sup>	1960	1961
<u>P. pelagicus</u>	12 <sup>d</sup>	46	46
<u>L. hyperboreus</u>	165 <sup>d</sup>	304	300
<u>R. tridactyla</u>	24,000	26,000	no change <sup>b</sup>
<u>Uria</u>	176,000 <sup>e</sup>	393,000	no change <sup>b</sup>
<u>C. grylle</u>	10	10	2
<u>C. columba</u>	10	2	10
<u>F. corniculata</u>	950	1,900	no change <sup>c</sup>
<u>L. cirrhata</u>	22	36	40

- Census error was greatest, especially with Uria and F. corniculata, in 1959 when methods were in early stages of development.
- In 1961, populations were checked by sampling part of the total and comparing results with 1960 data.
- Counts of nest sites were made for over 90 per cent of the population and compared with 1960 data.
- These figures represent data from only part of the cliffs.
- This figure represents the birds still resident at the time of census but does not include the entire breeding population of that year since departure of chicks and adults had already begun before census was possible. The two species of Uria were not differentiated in 1959. In 1960, of 244,352 birds individually counted, 40 per cent were U. aalge, 60 per cent U. lomvia. These proportions remained essentially the same in 1961.

INTERSPECIFIC DIET DIFFERENCES IN A GROUP OF SYMPATRIC ANATINAE. P.J.S. Olney. The Wildfowl Trust, Slimbridge, Gloucestershire, England.

From field observations and viscera analyses of seven Anatinae species which frequent two small saltmarsh islands in the River Medway, Kent, it is apparent that these species have food requirements which overlap to some degree. There are, however, differences in anatomy and behaviour patterns which make it seem likely that to some extent they are exploiting the same area in different ways. In the case of the mollusc Hydrobia ulvae (Pennant) though, which is the main animal food, taken by six of the species, the similarity in diet is probably indicative of the prey's abundance - c.12,000 per sq.metre.

There are the more obvious segregations into different feeding niches for some of the species - Bucephala c. clangula (L.) has a predominantly animal diet, mainly crustacea, which it obtains by diving in the deeper channels which separate the islands - Tadorna tadorna (L.) which shows the most fixed feeding pattern, feeds almost exclusively on H.ulvae obtained mainly on the ebb-tide in the intertidal zone - the only grazer Anas penelope L. feeds entirely on plant material, either algae (Enteromorpha, Ulva, Vaucheria) from the mudflats, various grasses from the nearby reclaimed island of Chetney, or on the leaf and shoot of Potamogeton pectinatus L. from the brackish ditches of Chetney.

The other four Anas spp., A. p. platyrhynchos L., A. c. crecca L., A. a. acuta L. and A. clypeata L. feed in similar habitats and have diets in which the most important food items (e.g. seeds of Scirpus maritimus L. and Salicornia spp., and H. ulvae) are common to all. There are sufficient differences in structure and behaviour, however, to suggest that these species are partially segregated - particularly when food is scarce - but differences in food selection are rarely absolute, and are more a matter of degree.

**CAN FOOD CONTROL THE NUMBERS OF SMALL RODENTS IN THE DECIDUOUS FOREST?** Władysław Grodziński, Department of Animal Genetics and Organic Evolution, Jagiellonian University, Cracow, Poland.

Bioenergetic balance of small mammals in a climax forest of Querceto-Carpinetum type was analyzed to determine whether the numbers of these animals are controlled by food. The balance depends on (1) the food supply provided by the forest, (2) the number of small mammals in the forest, (3) the metabolism rate and bioenergetics of small rodents, and (4) the food preference of these animals (Grodziński, 1961, 1962; Górecki and Gębczyńska, 1962).

The food supply available to small mammals in this deciduous forest changes with the seasons. Caloric value of plants, seeds, and small invertebrates of the forest floor fluctuates between 1.2 and 2.0 million kcal/hectare (=2.47 acres) during spring, summer, and autumn, falling to about 300,000 kcal/hectare at the end of winter and during the short prevernal period.

The composition of the small mammal community of the forest floor was found to be as follows: Clethrionomys glareolus Schr., 42.0%; Apodemus flavicollis Melch., 20.2%; Sorex araneus L., 15.8%; Apodemus agrarius Pall., 10.4%; Apodemus silvaticus L., 4.1%; Sorex minutus L., 4.1%; and Microtus agrestis L., 3.4%. The average population density was estimated at 40 mammals per hectare at the end of winter. These voles and mice are polyphagous, they change their diet during the yearly cycle, and can eat a great majority of vegetable and animal foods of the forest.

The diurnal oxygen consumption at 20°C corresponds to 618.3 cal/g in C. glareolus, 599.4 cal/g in A. agrarius, 507.2 cal/g in A. flavicollis, and 537.9 cal/g in M. agrestis. Consequently these rodents consume, respectively, 12.4, 12.5, 14.6 and 17.9 kcal/day, as computed for average body weight. The daily energy dissipation for the whole community of small mammals in the prevernal period reaches a level of about 506 kcal/hectare. With corrections for temperature, activity, and group effects this figure can reach 625 kcal/hectare per day.

The critical food period lasts about 3 weeks, when the winter passes into the prevernal period. To survive this period, the community of small mammals with a density of 40 individuals per hectare needs about 12,000 kcal/hectare in the form of food. Now at the end of winter, the foods available amount to more than 300,000 kcal/hectare, of which 75,750 kcal/hectare corresponds to tree seeds. Therefore, if the small mammals fed exclusively on seeds, which is their favorite food, they would have exploited, during these 3 weeks, only 16.5% of the seed supply alone.

The bioenergetic balance therefore indicates that, in the Querceto-Carpinetum forest, food cannot be the factor limiting the small rodent populations directly (i.e. by starvation in the spring). The amount and quality of food can influence the numbers of wood rodents only indirectly, e.g. by affecting their fertility and diurnal activity.

ANALYSIS OF REPRODUCTION IN A BLACK-TAILED JACK RABBIT POPULATION.  
Norman R. French, Laboratory of Nuclear Medicine and Radiation  
Biology, University of California, Los Angeles, California.

Reproduction by Black-tailed jack rabbits, Lepus californicus, was recorded from embryo counts in animals collected over a period of six years. During five of the six years, the number of animals in the population was increasing. Between the breeding seasons of the fifth and sixth years there was a sharp decline in numbers of jack rabbits, so that the sixth year was one of very low population density.

Changes in reproduction were correlated with changing population density. As density increased the length of the breeding season decreased. As density increased, a smaller percentage of females in the population were pregnant. As density increased, fewer embryos were produced by the population. After the population decline, the breeding season was longer, a greater percentage of the females were pregnant, and the average number of embryos increased.

The first embryos generally appear in the month of February. Litter size in each season was maximum in May. Frequency of pregnancy among females normally was maximum at least one month earlier. In two seasons when onset of breeding was delayed until March, maximum frequency of pregnancy coincided with maximum litter size, resulting in apparent compensation for the late start by greater-than-normal production of embryos by the population in May.

Production of young by the Black-tailed jack rabbit population is apparently controlled in density-dependent fashion. Adversities affecting the onset of breeding in any one season appear not to exert a controlling influence on the population.

ПОСЕЛЕНИЯ ПУСТЫННЫХ ГРЫЗУНОВ И ИХ ДИНАМИКА. Н.П.Наумов, Биолого-почвенный факультет, Московский университет, Москва, С.С.С.Р.

В группах зверьков, живущих в различных ландшафтах, отличаются скорость роста, сроки созревания, интенсивность размножения, подвижность зверьков, половой и возрастной состав. Разделяя обитателей разных ландшафтов, эти различия объединяют особей каждой группы в естественное целое — популяцию. Особенности даже мелких групп грызунов сохраняются постоянно, но не все устойчивы.

Наименьшие по величине элементарные популяции состоят из обитателей части биотопа (фации). У больших песчанок *Peromyscus eremicus* в глинистых пустынях Казахстана они занимают площади в 100–1000 га, разделенные незаселенными участками. В островных песках эти площади возрастают до неск. тыс. га, а в ячеистых песках и на ровных плато поселения не расчленены на элементарные популяции. У сусликов *Citellus* расчлененность поселений также возрастает в мозаичном ландшафте. Постоянно существуют лишь элементарные популяции в стациях переживания; прочие места заселяются временно.

Совокупность элементарных популяций составляет экологическую популяцию, занимающую данный биотоп. Живущие в однотонных ландшафтах и не расчлененные на элементарные группы экологические популяции отличаются неустойчивой численностью и иногда нацело вымирают, восстанавливаясь за счет иммиграции. Наиболее устойчивы популяции всех видов грызунов в мозаичных биотопах.

Общность физико-географических условий одного географического района объединяет живущие в нем мелкие популяции в одну географическую, отличающуюся единым ритмом биологических явлений. Географические популяции вполне самостоятельны и независимы от соседей. Только на периферии они обмениваются зверьками, но обычно в небольших размерах. Однако на периферии ареала многие популяции могут существовать лишь при помощи постоянной или периодической иммиграции из оптимальных зон.

Таким образом, каждый вид пустынных грызунов — сложная совокупность относительно самостоятельных популяций разного ранга и стойкости; мелкие входят в состав крупных. Все они связаны друг с другом обменом особями при сезонных миграциях и особенно при расселении молодняка. Численность вида отличается наибольшей устойчивостью в поселениях со сложной структурой популяции.

SOME CONSIDERATIONS ON ANIMAL SYNANTHROPY. Dalibor Povolný,  
Zemědělská 1, Brno, Czechoslovakia.

In the ecological literature of the English and German speaking world, the terms "synanthrope," or "synanthropic" have been applied for a rather long time, referring, as a rule, to animals in which the respective writers observe a certain relationship to man and his activity. As in all cases in which a term characterizes a phenomenon or a relation with but one meaning, the term "synanthropy," too, should be precise in order to avoid ambiguity or to prevent it from being interpreted too freely. This is essential because, like other branches of science, animal ecology must be based on absolute consistency, postulating that terms denote phenomena defined as unambiguously as possible and that a respective term be applied by all authors to express one and the same idea. This is of special importance in animal ecology, where despite a substantial approximation of views, certain terminological differences are still more or less constant in papers written in English or German. As far as the phenomenon denoted as "synanthropy" is concerned, developments suggest that it is of both theoretical and considerable practical importance so that the elucidation of this term is particularly desirable.

The authors attempt to define, as unambiguously as possible, synanthropy as an ecological phenomenon is based on the general acceptance of biocenosis or zoocenosis, in the respective senses of two existing philosophical conceptions, as either a concrete individual or merely an abstraction of animal community, existing as an individual of higher order only in concrete and very limited periods of time. Furthermore, it is based on the view that biocenoses, too, are or were going through their evolution, both a natural one, and, above all, a secondary one, influenced by the activity of man. Thus, looking for the evolution of synanthropy, one cannot help looking for the evolution of biocenoses. From this point of view, the existing biocenoses can be substantially divided into two groups, viz. (a) primary, or natural biocenoses, and (b) secondary, or cultural biocenoses. The second group comprises all types of biocenoses, the composition of which has in a way been influenced by the activity of man from biocenoses influenced by occasional utilization up to those of a cultivated steppe, with their highly developed monocultures and with all that results from their being rationally cultivated by man. Thus, secondary biocenoses have been developed wherever the interference of man with nature has gradually resulted, starting from primitive adaptation of vegetation (and the development of agrobiocenoses), in cultivation of highly improved plants (monocultural cenoses). Naturally, the animal communities of secondary biocenoses developed, through zoocenological elimination, from the communities of the original eubiocenoses; thence, they consist of those species whose ecological valency either enabled their adaptation to newly developed conditions or even led them to better utilization of the new environment compared to the original one. An analogical



process started as soon as the animals, domesticated by man, became the subject of his intensive economic interest. Man commenced an artificial elimination of animals from eubiocenosis, but, at the same time, he had also to confine these animals more or less permanently in his residence, to create necessary stores of fodder, etc. Thus, man has created a special type of secondary biocenosis of human residence, or anthropobiocenosis, originally being a common residence of man and domesticated animals. This biocenosis is mainly characterized by the absence of producers, for man had to bring all products into his residence from the outside world. Besides, a third group of animals became members of the anthropobiocenosis, with man not knowing or wishing this to take place. Such was the evolution of the biocenosis of human residence, existing even in its present state and consisting of the following three components:

- (a) man, being its creator;
- (b) domestic animals, being its products; and
- (c) synanthropic animals, being its spontaneous members.

It follows that "synanthropy" means a spontaneous membership in anthropobiocenosis, without or against man's objective. Naturally, there are various stimuli leading the synanthropic animals to their spontaneous membership in the anthropobiocenosis, reflected in the unusually wide range of synanthropic animals, as far as their relationship to human residence is concerned. Substantially, we may discern three components again. The first one consists of animals connected with anthropobiocenosis directly through man (e.g., commensals of man). A second group may consist of those animals whose membership in the anthropobiocenosis is realized through domestic animals (e.g., numerous coprophagus and ectoparasitic flies). Finally, a third group may be formed by those animals which find suitable shelter within the human residence itself. Naturally, the three above mentioned types of relationship do not nearly cover all existing eventualities. However, it must be understood that the stimuli leading the various animals to their membership in the anthropobiocenosis may be manifold. This must be born in mind as the synanthropy of animals may appear in various degrees and, also, in variously close or qualitatively different relations. Thence, the classification of synanthropy is a much more complicated task than a general definition of synanthropy. Notwithstanding, it is of great importance that an unambiguous definition of this ecological category may be reached only through a consistent conception of synanthropy as a biocenotic feature.

ОБЩИЙ АНАЛИЗ МОРФОЛОГИЧЕСКИХ ОСОБЕННОСТЕЙ ПОПУЛЯЦИИ НАЗЕМНЫХ ПОЗВОНОЧНЫХ ЖИВОТНЫХ. Станислав Шварц, Институт биологии Уральского Филиала Академии Наук СССР, Свердловск, СССР.

Популяция — это элементарная совокупность особей, обладающая всеми необходимыми свойствами для поддержания оптимальной численности вида в конкретных условиях среды. На изменение условий среды вид реагирует изменением структуры популяции, которое отражается и на ее морфологических особенностях.

Морфологическая специфика слагающих популяцию особей определяется их генетическими особенностями и условиями среды, формирующими конкретный фенотип животного. Это доказывается следующими наблюдениями: чем разнообразнее условия существования популяции, тем выше ее генотипическая и фенотипическая изменчивость (с продвижением к границам ареала вид становится более стеногопным и его изменчивость сокращается); изменение условий среды приводит к изменению средней нормы изменчивости популяции; происходящее в результате внутривидовой гибридизации резкое увеличение генетической разнородности популяции не всегда сопровождается соответствующим изменением ее фенотипической изменчивости (унифицирующее влияние среды, экспериментальные данные).

Генотипическое и фенотипическое единство популяции проявляется на фоне ее генетической разнородности, повышающей способность вида приспособительно реагировать на изменение условий среды. Происходящее при изменении направления отбора преобразование популяции ведет к изменению средней нормы ее изменчивости, по своим масштабам соизмеримое с различиями между резко выраженными подвидами и сопровождается появлением "новых" признаков (изменчивость идет в направлении отбора). У видов со сложной возрастной структурой поселения морфологическая разнородность популяции в значительной степени определяется особенностями сезонных генераций животных. Эти особенности обычно являются модификационными, но общее усложнение возрастной структуры популяции приводит к увеличению диапазона ее генетической изменчивости.

Общие законы преобразования морфологических особенностей популяций находят отражение и в географической изменчивости животных, проявляющейся как в форме клинальной изменчивости, так и в образовании подвидов. Формирование характерных особенностей подвидов в значительной степени определяется условиями существования животных. Поэтому в разных частях ареала вида, но в сходных условиях среды формируются сходные по своим морфологическим особенностям подвиды (иллюстрируется анализом морфологических особенностей некоторых видов грызунов в Азии и Америке). Если постепенное изменение условий среды вызывает постепенное изменение морфологических особенностей вида, наблюдается клинальная изменчивость; если же изменение морфологии вида может произойти лишь вследствие относительно значительных изменений условий существования — неизбежно возникновение относительно обособленных в морфологическом отношении групп популяций — подвидов. Реакция различных видов на сходное изменение условий среды различна.

Основные положения доклада подтверждаются анализом изменчивости комплекса морфологических и некоторых физиологических признаков у 5 видов амфибий, 2 видов рептилий, более 60 видов птиц и более 20 видов млекопитающих в различных условиях среды (от степей до тундры) и экспериментальными исследованиями, проведенными на 6 видах млекопитающих.

DYNAMICS OF AN ISLAND POPULATION OF RHESUS MONKEYS. Carl B. Koford, National Institute of Neurological Diseases and Blindness, Playa Humacao, Puerto Rico.

More than 450 monkeys (*Macaca mulatta*) range free on Cayo Santiago, a wooded 40-acre islet off the east coast of Puerto Rico. These animals descended from stock released there at the end of 1938. Although the monkeys eat various plants, most of their food is monkey chow which is provided at feeding stations. Since 1959 the animals have been observed for many hours each week and all have been accounted for. About one-fifth of the monkeys are infants, born during the current year, two-fifths are immatures, from 1 to 3 years old, and two-fifths are mature (sexually), at least 4 years old.

The annual reproductive cycle is pronounced. Over a period of five years the date of the first birth has ranged about 10 weeks, and of the median birth about 4 weeks. Typically, the sex skin of males reddens and the first females come into estrus in July. Mating occurs from July to January. Infants are born from January to July. The peak of birth rate usually falls in March. Up to 85% of the mature females give birth. At least 3% of the infants are stillborn. About 9% more die before the end of the calendar year. Mortality in yearlings is about 10%, but that in 2-year-olds is less than half as great. As age increases to adulthood (6 years old), the death rate of males increases while that of females decreases. Thus, among full adults there are less than half as many males as females, although the sexes are born in nearly equal numbers.

In 1957 the population comprised two bands of about 50 and 100 members. As numbers increased the larger band split in two. A year later one of the resultant bands divided into three parts. The next year one part divided again, so that by the end of 1960 there were six bands. There has been no further division. At the start of 1963 the bands contained from 20 to 133 members. In addition to females and young, each band includes adolescent and adult males, which form a dominance hierarchy. One or a few high-ranking males control various activities of the band. Adolescent males, 3 to 5 years old, usually remain at the periphery of the group. Aside from births and deaths, the major cause of change in the size of bands is the shifting of adolescent males from one band to another. Females rarely change bands.

Although climatic factors probably regulate the annual breeding cycle, individual and group characteristics also influence the time of mating. All the bands do not breed at quite the same time. In single years, the spread among the first birth dates in each band has been from 7 to 10 weeks, and among the median birth dates, from 3 to 5 weeks.

These studies are continuing. A comparable colony has been started on another islet in a drier zone of Puerto Rico.

METABOLISM OF SOME ALASKAN LAGOMORPHS, Eleanor G. Viereck,  
Arctic Aeromedical Laboratory, Ft. Wainwright, Alaska

Twenty snowshoe hares, Lepus americanus, were live-trapped near Fairbanks, Alaska during the winter of 1961-1962. Six of these animals were induced to turn brown by subjecting them to ordinary indoor laboratory temperatures and constant electric lighting. These brown animals were compared with white animals that had had similar indoor temperature histories and with white animals that had never been indoors. Oxygen consumption rates were determined using the open-circuit technique in an environmental chamber that could be regulated at temperatures from  $-75^{\circ}$  to  $+40^{\circ}\text{C}$ . The thermoneutral zone for the species is approximately  $-10^{\circ}$  to  $+10^{\circ}$  with no sharp boundaries at either end of the zone. Brown hares were put into the metabolism chamber in pairs in order to observe the effect of huddling together on the response to extreme environmental temperatures. The same experiment was performed with white hares. No significant differences were observed between any of the groups of animals. Therefore it was concluded that the seasonal coat color change from white to brown does not have a great influence on the ability of the Snowshoe Hare to endure exposure to cold, and that the opportunity to huddle together does not afford any particular advantage to the animals in the cold. The magnitude of increase in oxygen consumption at low temperatures ( $-50^{\circ}\text{C}$ ) was such that one is hard pressed to account for the necessary energy expenditure during cold spells in interior Alaska. Rectal temperatures were taken of the hares at  $+20^{\circ}\text{C}$  and after one, two, and three hours at  $-75^{\circ}\text{C}$ . The ability of the brown hares to maintain normal body temperature seems to be greater than that of the white ones, although the average drop in body temperature was never greater than  $3^{\circ}\text{C}$ .

Oxygen consumptions were obtained on five Pikas, Ochotona collaris, at ambient temperatures from  $-30^{\circ}\text{C}$  to  $+30^{\circ}\text{C}$ . Their thermoneutral zone does not extend much below  $0^{\circ}\text{C}$ , and their increase over basal metabolic rate at  $-10^{\circ}$  and  $-20^{\circ}\text{C}$  is about three-fold. It is postulated that an assessment of the relative significance of physiological and behavioral thermoregulatory mechanisms may be made in the following manner. Metabolic studies indicate the environmental temperatures at which a species is obliged to expend more energy than normal. Then one may examine the microclimatic temperatures of the species' habitat. If these are well below the critical temperature for the species, then it seems logical to conclude that the species employs some sort of behavioral thermoregulation.

PREDATION IN THE LEMMING CYCLE AT BARROW, ALASKA, 1951 - 63.  
 Frank A. Pitelka, Museum of Vertebrate Zoology and Department of Zoology,  
 University of California, Berkeley, California, USA.

Near Barrow, Alaska, recent peaks in the cycle of the brown lemming (Lemmus trimucronatus) have occurred in 1953, 1956, and 1960. In this paper the role of predators in these cycles is compared. A comment on significance of territoriality is added.

The most important species of lemming predator on the flat grass-sedge tundra of the Alaskan coastal plain is the pomarine jaeger (Stercorarius pomarinus). It is an obligate lemming predator when breeding. Nesting pairs are spaced on all-purpose territories defended through the breeding season. Other important predators are the snowy owl (Nyctea scandiaca), also territorial, and the least weasel (Mustela rixosa).

For the 1953 and 1956 peaks, basic facts regarding predators are given in references cited below. In the 1960 peak, early June densities of lemmings were higher than in 1953 or 1956, but the effective initial breeding density of jaegers was the same as in 1953 and 1956, about 18 pairs/sq. mi. At this density, breeding success may be moderate (1953), virtually nil (1956), or relatively high, as it was in 1960, when 57% of eggs laid produced fledging young. Here territoriality is food-related even at maximal densities. Data from non-peak years, at Barrow and other northern Alaskan localities (Maher, 1960) indicate that territory size varies inversely with food supply; at maximum breeding density of jaegers, outcome of breeding still can vary widely, and the territorial system assures effective production in at least some years.

In late summer, 1959, high reproductive success of lemmings resulted in so rapid a build-up of the prey population to the 1960 peak that least weasels never reached the numbers present in 1953 and 1956. In part because of the same factor, and in part because of the geographic extent of the 1960 high over the arctic Alaskan slope, breeding density of snowy owls near Barrow was lower than in 1956.

Recent findings reinforce earlier published statements, that "predators remove prey whose high population in any event cannot survive. Predation is the chief source of mortality in lemming peaks of the type that occurred near Barrow in '53 and '56," and now, '60. This effect is superimposed on the basic cycle of interaction between lemming-herbivore and vegetation, and it is not a major factor in the causal mechanism of the cycle.

#### References

- Maher, W. J. 1960. The relationship of the nesting density and breeding success of the pomarine jaeger to the population level of the brown lemming at Barrow, Alaska. Proc. 12th Alaskan Sci. Conf., pp. 24-25.  
 1961. The ecology of the pomarine, parasitic and long-tailed jaegers in northern Alaska. Ph.D. thesis, Univ. of California, 381 pp.  
 1961. Competition in the genus Stercorarius in northern Alaska. Bull. Ecol. Soc. Amer., 42:152.  
 Pitelka, F. A. 1958. Population studies of lemmings and lemming predators in northern Alaska. XV Int. Cong. Zool., Sect. X, Paper 5. (See earlier references cited therein.)

## MAMMAL DISTRIBUTION AND IT RELATIONSHIPS TO THE PLANT COVER.

Beatrica Dulic, Zoological Institute of the University, Zagreb, Yugoslavia.

Mammals are known to be animals inhabiting various biotopes. The question treated here is whether some species of small mammals like Insectivores and Rodents, could be regarded as characteristic for some plant communities and especially for forest associations, as it is the case with other animals, mostly Invertebrates. From the quantitative and qualitative distribution of Shrews, Mices and Voles investigated in north-western and southwestern parts of Yugoslavia it becomes evident that some species occur only in beech and fir woods, while the others could be found in oak woods too. This particularity is noticeable in woods, remained in some regions after the glaciation or situated in the most extended limit of the occurrence area of some mammals. In the centre of this distribution area some species are more euryvalent to plant cover differences than on its limits. From the distribution of forests the mammal fauna of those regions could be expected. Qualitatively beech and fir and sometimes spruce woods are richest, but quantitatively, small mammals are most abundant in oak woods represented by a few species only; pine woods being extremely poor on mammal fauna. Biocenological properties of a wood as a whole, such as its physiographic and ecological characteristics (microclimate, macroclimate, exposition, soil construction etc.) cannot be neglected when examining the factors to which the formation of a mammal community is due. Altitude seems to be less important.

INTRODUCTION OF EXOTIC SPECIES OF MAMMALS. E. Raymond Hall,  
Museum of Natural History, The University of Kansas, Lawrence,  
Kansas, USA.

From 1927 to 1953 inclusive 117,000 muskrats were introduced in 500 localities throughout the U.S.S.R.... In many regions the American raccoon was introduced, as was, in great quantity, the American mink (Mustela vison).

The fur of the American Mink and the Asian Sable are valuable because the demand for each exceeds the supply. But if the Mink thrives in Asia, where it has been introduced, and if the Sable is introduced into and thrives in America, the supply of each will exceed the demand. In that case neither the Mink nor the Sable will have much value and the introductions will have destroyed the economic values of two natural resources, one on each continent.

Aside from economic considerations, would it not be well because of shooting for recreation and sport to introduce the Prong-horned Antelope (Antilocapra americana) on the steppes of Astrakhan and to introduce the Saiga Antelope (Saiga tatarica) on the Great Plains of western Kansas? ....Many gunners disapprove because the recreation and rewards are mostly in the travel, in seeing new country, and in observing new animals in the lands where the species are native.

Attempts to introduce foreign species usually fail despite much effort and expense. One tenth of that effort and expense devoted to improving the habitat for a native species yields marvelous results.

In the rare instance of a successful introduction of an economically valuable species the value soon decreases because supply exceeds demand; worse still, any successful introduction is achieved at the expense of some native species; furthermore almost every species that is successfully introduced turns out after a few years to be a serious pest, and some carry parasites that adversely affect populations of native species.

Perusal of the Russian literature indicates that much is being done to conserve (wisely use) game species and to protect the fauna in the U.S.S.R. Limiting the times of hunting, closing certain areas to shooting, making scientific studies of habitat requirements, applying the results of scientific studies in order to increase populations of native species, and establishing migratory waterfowl refuges are examples of constructive actions.

Introducing an exotic species is a destructive action resulting from the ignorance of well-meaning persons and counteracts the constructive actions mentioned above. Introducing exotic species of vertebrates is unscientific, economically wasteful, politically short-sighted, and biologically wrong.

A THEORY OF SMALL MAMMAL INDEX TRAPPING. Ian Linn, Department of Zoology, The University, Exeter, England.

It is frequently desired in field investigations to assess the numbers of small mammals. Difficulties in doing so arise when time and resources are limited, or the work is a small part of a larger investigation. Under these circumstances a complete count or census is clearly impracticable. Even a population estimate based on one or other of the sampling techniques (partial census, mark-recapture estimate, removal estimate) may take too long or be otherwise undesirable. The investigator must therefore rely on obtaining a density index, despite the drawbacks of an assessment which is only relative, not absolute.

For a density index to be useful, the sample from which it is derived should be completely representative of the species, sex and age distribution of the population from which it has been drawn. Only the ordinary random variations of sampling should be present. Moreover, the technique used should be both sensitive and comprehensive - able to detect low population levels, yet not overloaded by high levels. Finally, the relationship between population and sample should remain linear throughout.

These specifications are notoriously difficult to fulfil in small mammal work, but it is suggested that they are largely met by the use of a short, dense line of traps left on the ground for only 24 hours. I set 50 Longworth traps in ten groups of five, each group within a two-metre diameter circle, groups spaced at five-metre intervals. Each trap should be camouflaged with vegetation or painted black (but not both).

It can be shown theoretically that such a line avoids entirely or limits considerably sample bias due to differential catchability, differences in activity rhythms, trap shyness, trap addiction and differences in range size. Disturbance of the population is minimal. The index will detect very low population levels, but even at high densities will seldom exceed 35 (70% of traps filled) so that linearity between population and sample is maintained and indices may be compared by simple statistical methods.

This method has been used in a number of investigations, under a wide variety of conditions, with encouraging results.



PSYCHOPHYSIOLOGICAL RESPONSE TO THE LEVEL OF ENVIRONMENTAL STIMULATION. Bruce L. Welch, Dept. of Biology, College of William and Mary, Williamsburg, Virginia.

Animals respond psychophysiologically in a sensitive and continuous manner to the level of stimulation which is characteristic of the environment in which they live. Their physiology and behavior is different, according to their environment.

The response to centrally active sympathomimetic amines, and the fertility of isolated animals, is changed by simple differences in spatial relations such as size of cage. Unfamiliar physical surroundings, noise, olfactory stimuli, and the perception of other individuals may elicit marked physiological changes.

Above a minimal density social interaction is the major factor which determines the level of environmental stimulation. Changes in population density are paralleled by changes in reproductive conditions, secretion of adrenal-cortical steroids, secretion of adrenal medullary hormones, response to centrally active sympathomimetic amines, and in the metabolism of certain compounds by the brain.

Because they experience a common level of environmental stimulation, animals of the same population are physiologically more alike, in many respects, than they are like members of any other population. In groups of men who were participating in sleep deprivation experiments, the level of plasma 17-hydroxycorticosteroids of individuals was characteristic for their group, and distinguished them from individuals in other groups. As population density increases, the number of possible combinations of inter-personal interactions increases, and the probability that populations of a given size will be physiologically alike become less. For instance, in populations of laboratory mice, the ratio of the variance between populations to the variance within populations (as regards adrenal weight) increased from 0.61 for paired mice to 3.31 for groups of 32 mice in one series of populations, from 1.16 for paired mice to 4.09 for groups of 32 in another series, and from 0.01 for paired mice to 3.13 for mice in groups of 8 in a third series.

A population has a physiological identity, which is implicitly related to the level of stimulation characteristic of its environment.

XVI INTERNATIONAL CONGRESS OF ZOOLOGY

SCIENTIFIC DEMONSTRATIONS

VARIABILITY IN THE TREMATODE, ORIENTOCREADIUM BATRACHOIDES  
TUBANGUI, 1931 [TREMATODA: ALLOCREADIIDAE]. Mary  
Beverley-Burton, Dept. of Zoology, University of the West  
Indies, Kingston, Jamaica.

Considerable synonymy within the genus Orientocreadium  
Tubangui, 1931 was recently proposed by the author  
 (Beverley-Burton, 1962), as a result of the comparison of the  
 salient morphological features; measurements of body, oral  
 and ventral suckers, and egg size; positions and extent of  
 uterus, gonads, vitellaria etc., of a number of worms from  
 several different hosts and localities in Southern  
 Rhodesia.

The present demonstration shows the morphological  
 variation encountered in this species when worms from the  
 same and different hosts are compared. The results of a  
 detailed statistical analysis of the variations observed  
 confirm the author's opinion that O. batrachoides Tubangui,  
 1931 is a much more variable form than has hitherto been  
 recognised, and strongly supports the proposed synonymy.

Histograms are shown of the distribution of the  
 morphometric characters in the material available.

Ref: Beverley-Burton, M. 1962. Proc. Helm. Soc. Wash.,  
29 (2), 103-115.

RESPONSE OF *TRIBOLIUM CONFUSUM* TO RADIATIONS AND OTHER STRESSES.  
H. S. Ducoff and Gayle C. Bosma, Department of Physiology and  
Biophysics, University of Illinois, Urbana, Illinois, U.S.A.

A number of workers have examined the acute lethal responses of X-irradiated *Tribolium* adults; the midlethal dose (MLD) range is 6 - 12 kiloroentgens (kr). Our laboratory's investigations reveal a MLD for larvae of 2.5 - 5 kr; X-irradiation of larvae leads to two other effects, a delay in pupation and, when very late larval stages are irradiated, morphological abnormalities in the resulting adults. First day pupae are about as sensitive as larvae, but by the third day, pupae are as resistant as adults. Eggs are more sensitive than larvae, and the sensitivity of the egg is an inverse function of its age: 2 kr causes 100% lethality in eggs less than 24 hours old. In addition, sublethal irradiation of eggs markedly inhibits the subsequent rate of growth and development.

X-ray effects on eggs and on pupae are mimicked by ultraviolet radiation; larvae, however, appear less sensitive than adults to the stress of high oxygen pressure.

The demonstration will include the dose-response curves of the various stages of the life cycle, examples of the induced developmental abnormalities, and a simple apparatus for exposure to high oxygen pressure.

MECHANISMS OF ANOXIC RESISTANCE OF THE NEWBORN MAMMAL. Laurence R. Fitzgerald, Department of Anatomy, University of Tennessee Medical Units, Memphis 3, Tennessee.

Data will be presented indicating the variation of resistance to anoxia in various newborn mammals. Various mechanisms have been proposed to explain this resistance, including: low cerebral metabolic rate, large size of the liver and high glycogen content, synthesis of fatty acids, fetal hemoglobin, anaerobic glycolysis, ability to reduce oxygen demand in response to oxygen lack and lower sensitivity of some sensitive "key" organ in the newborn. These suggestions will be critically examined in the light of effects of various factors on anoxic resistance.

It does not seem necessary to postulate special metabolic pathways in the newborn since the ability to remain viable in the presence of a markedly reduced oxygen supply is a general characteristic of living tissue. The inability of the adult mammal to survive these conditions is the biologically unique condition. The existence and identification of a particularly sensitive "key" organ is questionable, although cardiac damage from products of anaerobic glycolysis may play a major role in anoxic death.

CONTRIBUTION A LA PHYSIOLOGIE DU POISSON DIPNEUS-  
TE PROTOPTERUS, R. GODET, Faculté des Sciences, Univer-  
sité de Dakar (Sénégal).

Une étude des protoptères de la presqu'île du Cap Vert (Sénégal) nous a montré l'existence de races physiologiques en relation avec leurs aptitudes à la vie en cocon. Une race vivant dans les dépressions de terrain se desséchant pendant un temps court ( 1 à 3 mois), possède une activité thyroïdienne intense et des réserves lipidiques relativement réduites ( race S. ). Ceci par rapport à une autre race, fréquentant les dépressions se desséchant pendant un temps long (3 à 6 mois), possédant une activité thyroïdienne faible et d'importantes réserves lipidiques (race Th. ).

La race (Th. ) peut être maintenue 3 ans en cocon expérimental au laboratoire, et une substance dénommée par nous L  $\alpha$  a été extraite de sa queue. Elle possède des propriétés hypothermisantes chez le Rat, catatoniques et tranquilisantes chez le Singe sans modification appréciable du tracé électrique ( E. E. G. ).

L'E. E. G. sur le poisson au niveau du mésencéphale et du toit palléal présente des modifications au moment de la vie en cocon par rapport au stade aquatique.

Une étude de la région hypothalamo-hypophysaire a été faite sous diverses conditions. Nous avons mis en évidence des antagonismes dans cette région grâce à l'isolement de certaines portions par l'introduction de lames de polyéthylène. Il semble bien que l'hypophyse de nature pharyngienne inhibe la pars intermedia et que tout ce qui réalise une déplétion de la pars antérieur ( directement, ou indirectement au niveau des neuro-sécrétions) libère la pars intermedia. Celle-ci provoque alors la mélan-expansion et participe au métabolisme.

Au niveau du sang les méthodes d'électrophorèse et d'immuno-électrophorèse montrent la présence de gamma globulines et l'absence quasi totale de fractions rapides du type albumine. En cocon les lipoprotéines changent de mobilité. Un essai sur la signification de ces faits a été tenté.

Les différences raciales et celles qui résultent de l'état aquatique ou sec ont été étudiées à l'aide de  $^{131}\text{I}$  ; d'importants changements sur la fixation et sur les synthèses thyroïdiennes ont été observés.

A BRIEF DESCRIPTION ON "ILLUSTRATED ENCYCLOPEDIA OF THE FAUNA OF KOREA". YUNG SUN KANG, DEPARTMENT OF ZOOLOGY, SEOUL NATIONAL UNIVERSITY, SEOUL, KOREA

With the view to encourage biological studies in Korea, the Ministry of Education, Republic of Korea, has published three volumes of "Illustrated Encyclopedia of the Fauna of Korea" as a part of the series the Ministry is planning to publish with the cooperation of Korean biologists. Practically no similar book has yet appeared in Korea though there are some which cover only a certain particular field.

The volumes consist of butterflies, fishes, and birds of Korea. Each volume describes classification, geographical distribution, and utility of the animals in Korea in common. All volumes are 10.7 x 7.5 inch size, cloth-bound.

The following is very brief descriptions of each volume of the series.

1. Insecta Rhopalocera: edited by Pok Sung Cho, professor of Korea University, 43 colored plates, 197 page descriptions. It contains 251 species of butterflies known to exist in Korea. The contents are: Plates, Description, List, Diagram of geographical distribution, Bibliography, Systematic index, Alphabetical index, and Index of Korean names. Published in 1959.

2. Fishes: edited by Moon Ki Chung, professor of Dong-Kook University, 72 pages of colored plates, 239 pages of pictures, 690 pages of description, 166 pages of appendix and index, comprising of a total of 1500 pages. It contains 854 species of fishes identified in Korea and embodies classification, morphology, habitation, distribution, and dialects of each species in a clear and concise form, followed by references. Published in 1961.

3. Aves: edited by Yung Sun Kang, professor of Seoul University, 186 pages of color plates, 637 pictures in 198 pages, 532 figures, 647 pages of description. The book contains all 431 kinds of birds known to exist in Korea. The descriptions on each species contain species name, English name, Japanese name, Korean name, morphology, life history, habitation, distribution, and references, followed by illustrations. Breeding methods for 25 kinds of wild birds are also contained in the annex. Separate descriptions on 67 domestic birds are contained in 36 pages. Finally, taxonomical keys for 431 species and pictures of some eggs and young are seen. Published in 1963.

DEMONSTRATION OF LIVING BIVALVED GASTROPODS. Siro Kawaguti,  
Dept. of Biology, Okayama University, Okayama, Japan.

In 1959 a bivalved gastropod, Tamanovalva limax, was found in the Seto Inland Sea near the Tamano Marine Laboratory of Okayama University. It was described immediately (1) and has aroused deep interest in many scholars (2, 3). Since that time, related animals have been reported from various parts of the Pacific and Atlantic Oceans, such as South Australia (4, 5), Hawaii (6), Baja California (7), and Jamaica (8).

It has a green bivalved shell of 8 mm in maximum length. But, it is a sacchoglossan gastropod and has an embryonic helical shell at the top of the left valve. It lives on a green alga, Gaulerpa okamurae, throughout its whole life and has no free living state. Thus it has been possible to culture it successfully in the laboratory in a small bottle for more than ten generations. The whole life cycle of the animal, including embryonic development, process of metamorphosis (9, 10), and spawning (11), has become clear.

Living specimens at various stages of development, from egg to adult, will be demonstrated at the meeting.

A second bivalved gastropod, Julia, has been found alive in 1962, by Dr. A. Kay in Hawaii (6) and at Mishima, Yamaguchi Pref., Japan, by my colleague and myself (12). Julia japonica has a free living stage in its development and has not yet successfully been raised in the laboratory. If possible, however, a living adult Julia will appear with Tamanovalva in the exhibition.

1. Kawaguti, S. and K. Baba, 1959, Biol. Jour. Okayama Univ., 5, 177-184.
2. Cox, L.R. and W.J. Rees, 1960, Nature, 185, 749-751.
3. Keen, A.M., 1960, Veliger, 3, 28-30.
4. Burn, R., 1960, Nature, 187, 44-46.
5. -----, 1960, ibid., 188, 680-681.
6. Kay, A., 1962, Personal communication.
7. Keen, A.M. and A.G. Smith, 1961, Proc. California Acad. Sci., Fourth Series, 30, 47-66.
8. Edmunds, M., 1962, Nature, 195, 402.
9. Kawaguti, S., 1959, Proc. Japan Academy, 35, 607-611.
10. Kawaguti, S. and T. Yamasu, 1960, Biol. Jour. Okayama Univ., 6, 150-159.
11. -----, 1960, ibid., 6, 133-149.
12. -----, 1962, Proc. Japan Academy, 38, 284-287.



HUMIDITY RESPONSES AND THE SURVIVAL OF AQUATIC ISOPODS AND AMPHIPODS IN THE AIR. Kari Lagerspetz, Dept. of Zoology, University of Turku, Turku, Finland.

The behavioural reactions of the aquatic isopod Asellus aquaticus, and of the aquatic amphipods Gammarus duebeni and G. oceanicus to differences in the relative humidity of the air have been studied using an alternative chamber apparatus. The positive results obtained with these species are demonstrated by diagrams and track recordings. These three species live either in shallow, often temporary pools (Asellus, G. duebeni) or in the intertidal zone (G. oceanicus). The isopod Idotea baltica, typical for the tideless Baltic, and the amphipod Pontoporeia affinis, which lives below the tide-marks, do not react to differences in the humidity of the air. Data concerning the speed of movement on land and on the survival time in air are presented.

USE OF GROWTH RATE OF REEF CORALS TO STUDY PAST CLIMATE AND FOLLOW OUT THE COURSE OF POLAR WANDERING WITH ACCOMPANYING DRIFT OF CONTINENTS. Ting-Ying H. Ma, Dept. of Geology, National Taiwan University, Taipei, Taiwan, China.

Features of seasonal growth of fossil reef corals of the geologic periods from the Ordovician to the Upper Pleistocene are no different from those of living forms. The hinderance of growth by seasonal turbidity sediments, as has been experimentally proved for living forms, is also found in the fossil forms.

The growth-temperature graphs for living forms show that the annual growth values of reef corals are directly proportional to the mean temperature of sea water of the coldest month where it is below 25°C. The 25°C isothermals of February for the Northern Hemisphere and of August for the Southern are therefore taken as the boundaries to separate the coralline seas into an inner and two outer belts. Where the mean temperature of the coldest month is above 25°C the growth values are maximum and temperature is no more a controlling factor, but turbidity becomes more influential to mark out seasonal growth.

The growth-latitude graphs show that the growth values are roughly inversely proportional to latitude. For the outer belts the irregularities in the latitudinal distribution of the values agree with the non-parallelism of the isothermals of the coldest month to latitude, but for the same longitude the values are roughly inversely proportional to latitude due to being directly proportional to temperature and intensity of light. For the inner belt where temperature has no control the values are also roughly inversely proportional to latitude but the increase per degree of decrease in latitude is much smaller and may be attributed only to increase in light intensity.

The central line of the inner belt of the living coralline seas generally coincides with the equator so that for fossil coralline seas it may be taken as the equator. With Eurasia fixed in its present mesh of longitudes and latitudes, adjusting the central lines of the displaced and fragmented coralline seas of each period into a great circle brings out the relative positions of continents and the pole positions of that period as in Maps A. Rotating Maps A so that the two pole positions occupy 90° latitude puts the continents at their true latitudinal positions for each period as in Maps B, which together give the course of the sudden total displacements of the solid earth shell and the accompanying drift of continents. The similarity between fossil and living reef corals in latitudinal distribution of annual growth values proves the permanency climate throughout the geologic ages.

PROTECTIVE VARIATION ILLUSTRATED IN THE CLAM Donax variabilis Say AND THE  
BRITTLESTAR Ophiopholis aculeata (L.). Gairdner B. Moment  
Department of Biological Sciences, Goucher College, Baltimore, Md.U.S.A.

Two of the most beautiful cases of massive polymorphism in color and pattern occur in the little coquina or "butterfly" clam Donax variabilis Say and in the inshore brittlestar Ophiopholis aculeata (L.). In both species variation is so great that almost no two individuals look alike. It is quite impossible to designate any particular condition as wild-type and all others as mutants.

In D. variabilis the shells range from pure white to yellow, orange, green, pale blue, lavender, deep purple, red, pink, and brown. These colors may be uniform over the entire shell or may follow the lines of growth making concentric bands. In many cases brown streaks radiate from the umbo. When combined with the concentric bands a plaid results. This species occurs, often in great abundance, on the almost continuous sandy beach from southern Maryland to Florida and around to Texas. The clams migrate daily up and down the beach with the surf and are preyed upon by birds.

In O. aculeata variation is as great or greater and involves both disc and arms. Colors vary from red and purples to browns, near blacks, light yellows, deep yellows, oranges, and pinks. The disc may be uniform in color with or without a continuous or discontinuous border of a different color, or the disc may be covered with a wide diversity of markings. Similar variation is seen on the arms. These North Atlantic brittlestars are eaten by fish and possibly by birds.

It has been suggested by Cain and Sheppard (1954, Genetics 39: 89-116) and Haldane (1955, Proc. Roy. Soc. B, 144: 217-220) in connection with the much studied land snail Cepaea nemoralis that polymorphism might confer protection against visual predators by forcing them to learn the edibility of each type separately. Sheppard (1958, Natural Selection and Heredity) while presenting evidence that this is not the case in C. nemoralis, argues that variability in color and pattern would generally be favored by selection in species subject to visual predation such as cryptically colored moths. Our own observations indicate that protective variation is about as common as mimicry and is found in certain actiniaria, Cerianthus americanus; polychaetes, Hydroides and Sabella; gastropods, Neritina and others; several genera of chitons (kindness of S.S.Berry); grasshoppers (locusts); and probably the tropical Chlorophoneus shrikes (kindness of D.F. Owen); as well as in the two species described above. The phenomenon appears to be due to a special case of balanced selection which may be appropriately termed reflexive selection (Moment, 1962, Science, 136: 262-263) because it is the variation per se which is adaptive, rather than some special fitness of the heterozygote as in sickle cell anemia, and the frequency of any one type is determined by a feedback relationship with many other types.

APPLICATION D'UNE METHODE DE PERFUSION PHYSIOLOGIQUE A L'ETUDE ANATOMIQUE DE LA VASCULARISATION PLACENTAIRE CHEZ LES RONGEURS ET LES BOVIDES (Démonstration Scientifique). Maurice Panigel, Unité de Physiologie placentaire (I.N.H.) et Laboratoire d'Evolution (Biologie Générale), Faculté des Sciences, Paris, France.

Les anatomistes savent depuis très longtemps quelle est l'importance du lavage préalable des vaisseaux sanguins, qui permet la pénétration de masses classiques d'injection dans les fines ramifications vasculaires. L'expulsion des cellules sanguines de la lumière des artérioles, veinules et capillaires ne peut s'effectuer sans dommage que si ce lavage est effectué à l'aide de liquides adéquats, dans des conditions physiologiques satisfaisantes. La déformation du trajet des vaisseaux, la déchirure de leurs tuniques, un simple oedème se produisant au niveau des réseaux capillaires suffisent à donner une image erronée de la forme et de la répartition des vaisseaux sanguins à l'intérieur d'un organe.

La vascularisation du placenta des Mammifères, organe où la circulation sanguine est particulièrement intense et où les rapports anatomiques entre les vaisseaux maternels et fœtaux sont difficiles à interpréter, ne fait pas exception à cette règle. D'où, l'indispensable précaution de soumettre les placentas à une perfusion lavage préalable à une température de 37°C à l'aide d'une pompe à perfusion pulsatile (type Lillehei par exemple), en surveillant par un enregistrement continu la pression et le débit dans le circuit de perfusion et en les maintenant dans les limites physiologiques.

Le choix du liquide permettant le lavage vasculaire présente une importance primordiale. A défaut de plasma hépariné appartenant à l'espèce animale étudiée, seules les solutions salines équilibrées et tamponnées, renfermant de grosses molécules (dextran, polyvinyl pyrrolidone) peuvent, en évitant l'oedème et en permettant la survie prolongée des vaisseaux, donner des résultats complètement satisfaisants. Le maintien de l'équilibre des gaz respiratoires: O<sub>2</sub> et CO<sub>2</sub> dissous dans le liquide circulant, l'utilisation de substances vaso-dilatatrices permettent aussi d'éviter ou de réduire les spasmes vasculaires qui s'opposent souvent à l'établissement d'un circuit artificiel de perfusion.

Nous démontrerons ici l'efficacité de cette technique, en présentant un certain nombre de préparations anatomiques, injections à l'encre de Chine et moulages au Rhodopas (anatomie par corrosion) de la vascularisation maternelle et fœtale dans des placentas de Rat, de Cobaye et de Vache.

RECHERCHES SUR LE SYSTEME NERVEUX DES  
INSECTES - G. Richard, Faculté des Sciences, Rennes  
France.

On présente des photographies et des modèles de reconstruction concernant : d'une part, le système nerveux périphérique, d'autre part le système nerveux central des Insectes. Les colorations de système nerveux périphérique sont obtenues au moyen de la méthode au bleu de méthylène. Les reconstructions de système nerveux central sont obtenues à partir de coupes sériées dessinées et assemblées suivant une méthode personnelle permettant éventuellement des prises de moulages. Les Insectes ayant servi à ces travaux appartiennent à divers ordres.

TRANSFER TO DESCENDENCY OF ALTERATIONS INDUCED IN THE  
WHITE LEGHORN BY REPEATED INJECTIONS OF HETEROLOGOUS BLOOD

J. Stroun, L. Stroun-Guttières, J. Rossi and M. Stroun,  
University clinic of internal medicine, Geneva, Switzerland.

The authors have repeatedly injected blood from the grey guinea fowl to successive generations of cocks and hens descending from a white Leghorn strain with stable characteristics. Concurrently with this test Leghorn group, they raised a check Leghorn group treated under identical conditions with blood from white Leghorn, and also a control Leghorn group left untreated. The blood taken from male and female birds is injected by the intra-peritoneal route every 3 to 5 days as soon as the subjects are 10 to 30 days old and for a period of 6 to 7 months. In each new generation obtained through artificial insemination, fowls remaining up to the standards of the white Leghorn are selected from both treated groups and submitted to the blood injections. Moreover, from among the  $F_4$  birds in the control group, the authors set up three new Leghorn groups treated under identical conditions with blood from Austhralorp, Rhode Island Red and white Leghorn respectively.

Results from  $F_0$  to  $F_6$  (February 1963) : No alterations are noticed in either check or control Leghorn groups. In the test group, however, which was submitted to injections of blood from grey guinea fowl, there are in each generation from  $F_1$  onward a few animals with alterations in the colour and quality of their feathers and in the pigmentation of their feet. Such alterations do not appear in the blood treated Leghorn fowls, but in birds of the following generation, independently of any injection whatsoever. They are maintained in the descendency which is no longer treated and are transmitted both by the mother and the father birds. In the groups treated with blood from Austhralorp and Rhode Island Red, alterations begin to appear as from  $F_2$ . The demonstration shows diagrams, pictures and preserved specimens of altered and normal birds.

THE MILLIPEDES AND CENTIPEDES OF TAIWAN, CHINA. Yu-hsi Moltze Wang, Dep't of Zoology, National Taiwan University, Taipei, Taiwan, China.

The millipedes and the centipedes of Taiwan islands are formed mainly by the oriental element as well as a very few holarctic element and australian element.

Of 51 species of the diplopods representing 24 genera, 10 families and 5 orders were found.

Of 62 forms of the chilopods were distributed in 21 genera, 12 families and 4 orders.

HIGH SCHOOL CURRICULUM MATERIALS PRODUCED BY THE BIOLOGICAL SCIENCES CURRICULUM STUDY, ESTABLISHED BY THE AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES AND FINANCED PRIMARILY BY THE NATIONAL SCIENCE FOUNDATION, Arnold B. Grobman, Director, University of Colorado, Boulder, Colo., USA and Bentley Glass, Chairman, Johns Hopkins University, Baltimore, Md., USA

Since 1959, under BSCS auspices, teams of outstanding high school biology teachers and research biologists have prepared curricular materials for use in high school biology courses, including: three parallel courses or versions for a first high school biology course (with laboratory manuals, texts and tests), a second high school biology course, materials for teachers, film for teachers, films for classroom use, materials for gifted students, materials for slow students, and special supplementary laboratory resource materials. Experimental editions of the materials for the first course in biology, BSCS HIGH SCHOOL BIOLOGY, Blue, Green and Yellow Versions, have already been used by over 1000 teachers with 165,000 students. All materials are revised after careful testing in classrooms and review by biologists and educators. Most of these BSCS HIGH SCHOOL BIOLOGY materials will be issued for general release in September 1963 in commercial editions.

At the request of a number of overseas countries, cooperative arrangements have been developed with such countries interested in adapting BSCS materials for their own use. Adaptation teams are currently active in Colombia, Brazil, Argentina, Thailand and the Republic of the Philippines.



## XVI INTERNATIONAL CONGRESS OF ZOOLOGY

### PAPERS PRESENTED BY TITLE ONLY

The authors of the following abstracts had planned to attend the Congress but, for one reason or another, were unable to do so. We regret that they could not be with us. Their abstracts will give a synopsis of the papers they would have presented.

**SYNAPSES-EXAMINATIONS ON THE HEART OF VAGOTOMISED EUROPEAN POND TORTOISES. Ambrus Ábrahám, Inst. of Zoology and Biology, University, Szeged, Hungary.**

Examinations on the heart of vagotomised European Pond tortoises concerning synapses resulted: the nerve cells in the cardiac wall are of two types. The nerve cells in the sinus venosus and in the atrial wall are parasympathetic. The nerve cells in the atrial epicardium and in the atrial and ventricular myocardium are sympathetic.

Around the parasympathetic cells there are pericellular plexuses of the most variable texture, whose end fibres are terminated on the cell surface. The pericellular plexuses may be considered to be synapses of large transmitting field.

No pericellular plexus is around the nerve cells of sympathetic type. These are characterised by the synapses of small transmitting field. They are generally small rings that are sometimes arranged in considerable numbers in a semispherical cavity, other times populate a part of the cell surface.

The synapses of the muscle fibres are smaller and larger rings seen everywhere in the cardiac wall, however, appearing in a incredible mass on the ventricular- atrial line. As the end rings are found in large number in every part of the myocardium and there is no either efferent end formation, we may state: The efferent fibres of the heart of the tortoise end freely and adjoin the muscle fibres with ring-like formation.

**L'INFLUENCE DE LA TEMPERATURE SUR L'EXISTENCE ET LA DISPERSION DE BOMBINA VARIEGATA (L.).** L. Berner, 59, rue de la République, Marseille 2<sup>o</sup> France.

Quelque peu irrégulièrement répandue dans le centre de la France cette espèce manque en Provence. Les indications de J. M. F. Réguis (1882) - reprises par L. Ph. Knoepfer (1961) - sont certainement dues à une confusion avec *Bufo bufo* (L.) dont les jeunes après la métamorphose ressemblent aux *Bombina* du même âge qui mènent d'abord une vie terrestre. Les derniers se distinguent des premiers uniquement par une petite tache jaune sur la paume des pattes.

Malgré toutes nos recherches de plusieurs lustres, nous n'en avons jamais rencontrés aux "Gours d'Allauch" (environs de Marseille) selon la mention de Réguis. D'accord avec d'autres auteurs, notamment Dr. J. V. Bedriaga (1889), G. A. Boulenger (1910), cette espèce n'est pas signalée pour la Provence selon Dr. R. Mertens (1928).

Etant donné que ce *Bombina* vit en Italie du Nord, mais manque sur la Péninsule ibérique (Dr. E. Schreiber - 1912), nous avons pu constater qu'en réalité c'est le régime thermique qui délimite sa répartition.

Stübing donne comme température préférentielle moyenne 21, 2<sup>o</sup>C pour *Bombina* qui supporte ici en captivité à l'état adulte 26-28<sup>o</sup>C, mais cesse de s'alimenter à partir de 30<sup>o</sup>C.

Cependant ses têtards ne vivent bien qu'au dessous de 18<sup>o</sup>C, cessent de s'alimenter entre 21-23<sup>o</sup>C et s'immobilisent à 26<sup>o</sup>C. Ils meurent ensuite. Déjà une température maintenue à 23<sup>o</sup>C leur devient mortelle.

Du reste, Héron-Royer (1887) a constaté - en voulant accélérer le développement des embryons de *Bombina* - en les exposant en lumière prolongée et à une température élevée, qu'ils dégénèrent.

Nous avons aussi observé que les femelles ne pondent plus dans une eau dépassant 18-20<sup>o</sup>C, alors que le mâle s'accouple encore à 21<sup>o</sup>C. Normalement la ponte a lieu ici d'avril au début d'août si l'eau ne dépasse pas 18<sup>o</sup>C, généralement la nuit.

Enfin, *Bombina* demeure stérile sans un repos hivernal de 2 à 4 mois sous une température au-dessous de 8<sup>o</sup>C.

#### CONCLUSION:

Les adultes supportent bien des températures plus élevées que leurs têtards, mais ne laissent pas de progéniture sans profond repos hivernal. En Provence les éclosions en avril et au début de mai peuvent encore parvenir à la métamorphose et les jeunes à se développer de façon à devenir adulte en 2 ou 3 ans, mais ils ne peuvent faire souche dans le pays - en liberté - parce que les adultes deviennent stériles faute d'un abaissement thermique hivernal assez prolongé. De toute manière, ils ne peuvent subsister en Provence dans les flaques d'eau permanentes qui s'échauffent trop facilement.

La répartition géographique de *Bombina variegata* dépend donc des températures maxima moyenne hivernales d'une part, et de celles des eaux d'autre part.

REMARQUES SUR LES NEMATODES PARASITES DE VERTEBRES MALGACHES  
Alain G. Chabaud, Lab. Zool. Vers, Museum nat.Hist.Nat.Paris

L'étude des Nématodes parasites de Vertébrés malgaches a été entreprise avec la collaboration de différents auteurs, et en particulier E.R. BRYGOO, A.J. PETTER et R.C. ANDERSON. Les résultats acquis restent très partiels, mais il semble possible de présenter quelques conclusions concernant les groupes les plus étudiés.

1 - Nématodes de Caméléons (20 espèces étudiées): La composition générique est comparable à celle des Caméléons d'autres régions mondiales. L'endémisme se manifeste à l'échelle spécifique.

2 - Spirurides et Filaires d'Oiseaux endémiques (23 espèces étudiées): L'endémisme reste marqué pour les Spirurides, mais devient relativement faible pour les Filaires qui offrent souvent des exemples de vicariance.

3 - Nématodes d'Insectivores (5 espèces étudiées): La composition de la faune nématologique est complètement différente de celle des Insectivores des autres régions. Les groupes habituellement dominants sont apparemment absents et sont remplacés par des représentants de familles beaucoup plus primitives.

4 - Nématodes de Lémuriens (13 espèces étudiées): L'endémisme est également très marqué puisque, pour 13 espèces, il y a 10 genres nouveaux. L'équilibre général de la Faune reste cependant assez comparable à celui des Simiens.

Donc, suivant ces données préliminaires, l'originalité de la parasitofaune, suivant l'hôte, croît dans l'ordre: Oiseaux-Caméléons-Lémuriens-Insectivores. Suivant les parasites, l'originalité semble plus marquée dans les groupes archaïques (Oxyures, certains Strongles et Spirurides) que dans les groupes évolués (certains Ascarides, Filaires).

Les caractéristiques classiques des faunes insulaires se manifestent avec autant de netteté chez les Nématodes parasites que chez les animaux libres, mais nous y trouvons surtout deux centres d'intérêt:

a) Les caractères adaptatifs sont très souvent hyperévolués, alors que les caractères phylétiques restent primitifs. Il est possible ainsi de séparer les uns des autres et de retrouver indirectement les conclusions des auteurs modernes sur la valeur relative des différents caractères.

b) Des groupes entiers (Aphasmediens, Heligmosomatides, Ascarides d'Oiseaux et de Mammifères) semblent rares ou absents. Il sera peut-être possible de déduire de ce fait quelques conclusions concernant les époques auxquelles les grands phylums de Nématodes parasites se sont adaptés à leurs hôtes.

ENDOPARASITISM IN MALAYAN FOREST MAMMALS. Frederick L. Dunn, Institute for Medical Research (University of California ICMRT Project), Kuala Lumpur, Federation of Malaya.

Parasites may serve as 'ecological labels' when habitat-specificity is high and host-specificity is low, and as 'phylogenetic labels' when host-specificity is high. Audy (1960) has demonstrated the value of certain ectoparasites (e.g. trombiculid mites) as ecological labels in vertebrate ecology. Vertebrate taxonomists have used highly host-specific parasites as aids in interpreting phylogenetic relationships.

An attempt is made in this paper to assess the extent to which endoparasites may be useful as labels in studies of certain Malayan forest mammals. The study was undertaken because of interest in the parasites of tree shrews (Tupauidae). These animals have long been classified as insectivores, but in recent years many zoologists have come to regard them as primitive primates.

The object of this study was two-fold: 1) to determine whether or not the endoparasites of tupauids shed any light on host phylogeny or ecology, and 2) to gain insight into the utility of endoparasites as labels in studies of other tropical forest animals. It was obviously necessary to analyze concurrently the parasite patterns of other mammals: those that share identical habitats with tree shrews and those that do not; those that are apparent relatives of tupauids and those that are not.

This study is based in part on helminth records from more than 5,200 mammals of 45 species dissected at this Institute between 1950-1962, and on parasites detected in blood films from more than 4,400 animals of the same species. First, prevalence rates were determined for parasites (using only higher taxonomic categories) for each of 4 basic habitat-groups: forest mammals of the canopy, under-canopy, and ground, and commensal mammals (see Harrison, 1961). The study was then extended to sub-groups of each habitat-group, based on day-night activity and diet. These broad host-parasite analyses reveal certain clear-cut patterns of parasitism. For example, under-canopy mammals (including tupauids) have the highest prevalence rates of all groups under investigation for nematodes, trematodes, and parasites of erythrocytes. The cestode rate is, however, lowest in this group, microfilarial infections are far less prevalent than in other forest mammals, and trypanosome and acanthocephalan rates are very low, in contrast to the rather high rates of all these in commensals. With background information of this type the basic endoparasite pattern that one might expect to find in tree shrews (as diurnal, under-canopy, mixed-diet mammals) can be generalized, compared with actual findings, and related to findings in mammals of other genera and higher categories belonging to the same or different ecologic sub-groups. This provides a starting point for closer inspection (at genus and species level) of the parasites of tree shrews and certain other mammals. The paper concludes with some speculations and conclusions about tree shrew phylogeny and ecology, and the value of mammalian endoparasites as 'labels'.

HERKUNFT UND ENTWICKLUNG DES FAUNISTISCHEN STEPPENKOMPLEXES  
DER TERRESTRISCHEN WIRBELTIERE IN DER RUMÄNISCHEN VOLKSREPUB-  
BLIK. Martin Hamar, Abt. Pflanzenschutz, Zentralinstitut für  
Landwirtschaftliche Forschungen, Bukarest, Rumänische Volksre-  
publik.

Die Steppengebiete nehmen einen wesentlichen Teil des Landes ein; sie erstrecken sich vom Nord-Östlichen Teil der Moldau zum Süden, über die Birlader Hochebene, den grössten Teil von Dobrudscha und die Donauer Tiefebene, die westlichen Zonen Transylvaniens und teilweise den Transylvanischen Talkessel. Die rumänische terrestrische Steppenwirbeltiere-Fauna besteht aus folgenden Elementen: a) autohtonische Arten; b) Artgruppen europäisch-sibirischer Herkunft; c) Arten östlicher (asiatischer) Steppen und Wüsten; d) mittelmeerische (Klein Asien-afrikanische) Artgruppen.

Das Schicksal dieser Gruppen in der Nachzeit ist verschieden. Die autohtonen Arten bewahren meistens ihr Areal, aber ihre Anzahl kann sich vermehren oder vermindern. Die Gruppe europäisch-sibirischer Herkunft ist gering; diese Arten dringen in die Steppenzone durch Flusstäler, Wälder und Waldinsel ein. In der Nacheisperiode, im Zusammenhang mit der Abnahme der Waldgebiete und der Verbreitung der Agrobiocenosen, verringert sich die Bedeutung dieser Gruppe. Die Artgruppe östlicher Herkunft, welche in der Nacheisperiode eine starke Verbreitung erwie- sie zieht im weiteren nach Osten zurück, die Anzahl von Arten vermindert sich, der Charakter des Areals wird relik- Die mittelmeerischen (kleinasiatischen) Arten erhalten sich teilweise als Tertiärrelikte; ein anderer Teil dringt in der Nacheisperiode zum Norden ein, durch Dobrudscha bis zu den felsigen Ausläufern der südlichen Karpathen, wobei sie die südliche Moldau, die südliche Ukraine, die Krim, die Panonische Tiefebene und den Transylvanischen Talkessel erreichen.

Auf diese Art bezeichnet sich auf der Grenze grosser faunistischer Einheiten, in diesem Fall auf der Scheide der europäisch-sibirischen und der mittelmeerischen Untergebiete, ein dynamisches Wechseleindringen verschiedener faunistischen Gruppen, was zu einer allmählichen Abweichung, in dem oder jenem Sinn, der hauptsächlichlichen Zusammensetzung der Fauna führen kann, je nach dem Veränderungscharakter der Landschaftsbedingungen, d.h. im gegebenen Fall zu der Geländegestaltung des deutlich abgesonderten faunistischen Steppenkomplexes, dessen Grundkern aus der altertümlichen Fauna Zentralasiatischer und Kleinasiatischer Herkunft besteht.

## ON THE DYNAMICS OF ZOOCOENOSES OF RIVER VALLEYS.

Ladislav Havranek, Inst. for Syst. Zool. of the University, Szeged, Hungary.

The little-mammal fauna of river valleys is dynamic in an interesting way. The animals are vertically and horizontally distributed.

## 1. Vertical distribution

- A. Terrioles /e.g. Talpa/ in the soil or on its surface
- B. Planticoles /e.g. Micromys/ on plants
- C. Arbiholes /e.g. Myotis/ in hollows and on trees

## 2. Horizontal distribution

- a. Hydrobionts /e.g. Neomys/ in the water, on water-plants
- b. Hydrophils /e.g. Micromys/ on the riverside
- c. Hydrograds /e.g. Apodemus/ in humid forests
- d. Xerophils /e.g. Citellus/ on arid, highly insolated places.

The groups of the horizontal distribution have a zonal arrangement. Next to the water occur the hydrobionts while the most remote the xerophils. The complete zonation develops only on larger inundation areas, on smaller ones the xerophils may be lacking.

Occurrence, dominance or subdominance of the animals depends on biogen and abiogen factors. These factors are equally important. The lack of any of them may disturb the equilibrium. Distinguished significance has, however, the height of the river. This may reduce or even abolish the effect of the factors. The relations between the biogen and abiogen factors describes the following formula:

$$D = \frac{S_x + E}{sw \cdot h}$$

D= occurrence of the species  
 Sx= possibilities of reproduction  
     /0 - 100, estimated/  
 E= possibilities of nutrition  
     /0 - 100, estimated/  
 sw= rate of flow / in m-sec./  
 h= height of the river /in cm., data of the  
     official water-level report/

Accordingly, occurrence of a mammal species is directly proportional to the biogen factors and indirectly proportional to the rate of flow and the height of the river.

An inundation change or exterminate the original zoocoenoses. After regression of the water begins the fauna-regeneration the rate of which is also determined by the above formula. In addition, this rate depends on the zoocoenoses of the back areas too. These may serve as asylum from which the remigration commence.

First motive of remigration are the better nutritional possibilities /E/ and than the more favourable conditions for reproduction.

INVESTIGATIONS OF THE REVERSIONARY TRENDS OF SOME PALEARCTIC BIRDS. Dr. L. Horváth, Natural History Museum, Budapest, Hungary.

There may be observed, even at a cursory glance, abnormalities in the plumage of some Palearctic birds which deserve a thorough investigation.

If there occur in a species aberrations of a nature which arise as normal features in another species of the same genus, then the aberration accounts for a kind of relationship between the two species either by indicating that they descended from a common ancestor or that the progenitor of the species displaying this aberration is the one which possesses it as a regular feature.

In the exposition and evaluation of the origin of the reversionary characters, we cannot rest content with the justified conclusion that the species under investigation is related to one or more species whose features occur on it in a decreased degree, but we have to go further to arrive at the statement that the investigated species together with the one or more species whose features are common with it originated from an earlier common ancestor or ancestors.

Arising out of my present investigations, we may establish the following stabilization of the specific characters. The higher the number, the extent and the intensity of the reversionary-aberrational characters are in a given species, so much later did it separate from the one or the more species to whose features it reverts - therefore the strength of the reversionary aberrations is conditional on the age of the species. It also follows that a decrease of the reversionary aberrations indicates the stabilization of the specific characters. If several characters of all species constituting a genus be observed among the reversionary-aberrational features of the one or the other species, they denote that, on the one hand, the genus is of a homogenous origin, and, on the other, the species exhibiting the mixed reversionary-aberrational peculiarities is in a flourishing state of specialization.



# INTEGRATION, ADAPTATION AND PROGRESSION-REGRESSION AS SYSTEMIC UNITY.

Gabriel Kolosváry, Institute for Syst. Zool. of the University, Táncsics M. street 2, Szeged, Hungary.

1. Conservativismsm /integrations/ are always relative /not-immobile/. As a result of investigation with variation-statistical methods they give a typical Quetelet-curve with limited variation. The two extreme values and the middle value are more or less stable. Actually they are changes returning into themselves.
2. Adaptations /elasticities/ give atypical curves with large variation as a result of investigation with variation-statistical methods. Consequently, they are polymorph. This polymorphism is the result of a considerable and luxuriant mobilization of the middle values, while the extreme values remain relatively constant. The curves are always bifurcate. The considerable deviations and divisions do not yet indicate progression!
3. Progressions /akmic deployments/ give one-sided ascendent curves or they conduce to further differentiations of the new, neoconstante /neointegrated/ curves from the polymorphic /adaptive/ ones. Therefore dynamisms mentioned in the points 1. - 3. proceed on spiral lines /never returning to themselves/.
4. Regressions /natural paracmic declines and also degenerations caused by diseases/ give one-sided descendent curves or through ceasing of the positive extremes conduce to extinction.  
Parakmic symptoms in the differentiations of the adaptations curves means regression too. Hereby these segregate themselves from the progressive-type curves /see point 3./.

In all these categories as in the system of the phenomena of life, from, constitution and function remain in an organized, unbreakable connected unity.

ENDOCRINE INFLUENCES ON PROTEIN AND FAT IN THE HEMOLYMPH OF THE  
 COCKROACH PERIPLANETA AMERICANA. Maya Menon, Department of Zoology,  
University College, Trivandrum, India.

To elucidate the physiological pathways involved in the action of the hormone from the corpus allatum in bringing about growth of eggs, the protein and fat content of the hemolymph of adult cockroaches (Periplaneta) under varied experimental conditions were looked into.

In paper electrophoresis 4 distinct negatively charged protein fractions have been found to be present in the serum. All these fractions seem to be influenced by the corpora allata because, when the glands are removed the bands become poorly defined and a restoration to normalcy could be effected by transplantation of the glands into allatectomised insects. Of these 4, fraction 2 seems to be more significant in relation to ovarian cycle. Newly emerged adult shows no indication of this; it fails to develop in allatectomised animals where the operation has been done in the last nymphal instar or immediately after attaining the adult stage. It decreases whenever the glands get removed, it rises when they get reimplanted, and castration results in accumulation of this being not utilised by ovarian tissues. Animals carrying ootheca also show accumulation of this fraction in hemolymph. In analysis of egg-extracts, fraction 2 alone becomes visible and a graded series of increasing concentration could be obtained along the linear series of growing eggs of the follicle. These indicate that the corpus allatum initiates egg-growth by making available serum proteins, especially fraction 2. Also, this confirms a view that has been only hinted at, that the corpus allatum elaborates a metabolic hormone.

Tests carried out to study serum fats by sudan black technique of Granitsas showed that it is very low in newly emerged adults of both sexes and a few days after adult molt serum fat level rises which is found to be more in the females than in the males. In allatectomised females, there is a conspicuous fall in serum fat while ovariectomised insects did not show much difference from that of the normal. A great rise in serum fat is observed in females carrying ootheca. These findings suggest a role for corpus allatum in fat metabolism also.

DISEASE IN LABORATORY HAMSTERS. Jer K. Mody and Sunanda V. Gothoskar, Department of Applied Biology, Indian Cancer Research Centre, Bombay 12, India.

Over sixty untreated Syrian hamsters above 12 months of age showed a variety of lesions, especially in the liver, the gall-bladder, the adrenal and the kidney.

Grossly, the liver varied little in size and colour. The consistency was rubbery and the liver bled profusely on cutting. Cysts containing clear or hemorrhagic fluid were often present on the surface of one or more lobes. Microscopically, fatty degeneration and liver cell necrosis were noted. Leucocytic infiltration, congested blood vessels and congested or occluded sinusoids were found. In the hepatic cells, large intra-nuclear inclusion bodies were seen in about half the number of animals. Usually, they were single and eosinophilic. Thickened lobular trabeculae were prominent. Hyalinised areas were extensively present in many livers and at least some, were positively amyloid deposition. At the portal tracts, plump cells resembling those of the bile ducts, proliferated. Many were arranged as pseudo-ductules. Small single or multiloculated cysts appeared in these areas. Histogenetically the cysts appear to be bile duct elements although the lining of the larger cysts was stretched beyond recognition.

The gall-bladder often possessed a number of tiny black granules and occasionally big stones. The stones were usually angular, smooth surfaced, shiny and black.

The adrenals in a few cases showed hemorrhage and necrosis of the cortex. Only a few cortical z.glomerulosa cells remained. The cortex was full of massive hemorrhages and hyaline thrombi.

The kidneys, in cases with advanced liver disease, were pale yellowish and deformed. Microscopically the glomerular tufts were greatly swollen, bloodless, distorted and hyalinised. Inflammatory cells were present both in the glomeruli and perivascularly in the interstitium. The tubules showed albuminous content. Colloid casts were present in the lumina. Protein precipitation occurred in the urine.

THE LYMPHOID ORGAN AS AN ENDOCRINE GLAND OF THE SCORPION  
HETEROMETRUS SCABER. K. K. Nayar, Department of Zoology,  
University College, Trivandrum, India.

Two elongated, tubular glands called lymphoid organs lie behind the coxal glands in the scorpion Heterometrus scaber. They are comparatively larger in females, and enlarge further during stages of pregnancy. Each gland is composed of a mass of cells with typical glandular inclusions. The organs have been described to be leucopoetic.

Administration of aqueous extracts and transplantation experiments have shown that the recipient scorpions become hyperexcited and suffered a progressive loss of the cellular contents of the intact organs. Isolated preparations of the gut of Periplaneta kept in insect-Ringer, showed an increased rate of peristalsis from 8 to 15 per minute when the extract was added to them. Extracts and crushed organs showed an apple-green fluorescence under ultraviolet, suggestive of catechol amines, though several histochemical tests for them gave only negative results. A hyperglycemic effect was observed on injection of aqueous extracts of the organs into the scorpion, when a five-fold increase in the reducing sugar content of the blood was observable within 2 hours of injection. These findings suggest that the lymphoid organs subserve an endocrine function, probably by elaborating catechol substances.

OBSERVATIONS BIOLOGIQUES SUR LES DIPLOURES JAPYGIDES. Jean Pagés, Laboratoire de Biologie Animale et Générale, Faculté des Sciences, Dijon, France.

Nos connaissances sur la biologie des Insectes Diploures sont très fragmentaires; des 6 familles constituant actuellement l'ordre seules celles des Campodeidae et des Japygidae ont fait l'objet d'études détaillées (von Orelli, 1956, Gyger, 1960); les premiers faciles à se procurer, presque exclusivement phytophages, d'un élevage assez aisé ne nécessitent plus que des études de biologie comparée; les seconds au contraire, beaucoup plus rares, carnassiers, difficiles à maintenir en vie sur de longues périodes demandent encore beaucoup de recherches. Des lots de Dipljapyx humberti (Grassi), espèce commune en France, conservés au laboratoire de 3 à 24 mois nous permettent d'apporter les précisions suivantes sur quelques points de la biologie de cette espèce.

1°/ Les Japyx creusent activement la terre mise à leur disposition au moyen des lobes internes des maxilles.

2°/ Un marquage des limites du territoire accessible est effectué au moyen d'une sécrétion des organes subcoxaux latéraux.

3°/ Avant les mues ou la ponte ces Insectes s'isolent dans des logettes hermétiquement closes qu'ils se construisent en prenant appui sur les parois du nid ou centre de gros graviers; si une logette de dimensions convenables est mise à leur disposition ils comblent soigneusement la galerie la reliant au reste du nid.

4°/ La période de mue se divise en phase d'isolement (de 11 à 129 jours dans nos élevages), phase de turgescence pendant laquelle l'animal devient totalement amorphe (de 7 à 43 jours), mue proprement dite (1 heure en moyenne), phase de coloration progressive (3 jours), sortie de la logette (3 à 8 jours après la mue). L'exuvie n'est pas ingérée et reste intacte sauf toutefois la région antérieure qui est machée plus ou moins longtemps 24 heures après l'ecdysis. Le nombre annuel de mues est apparemment très variable; il semble que normalement il y en ait 2, une précédant la période hivernale, une autre la suivant, au printemps ou au début de l'été; certains individus n'ont mué qu'une fois en 12 mois, d'autres, des ♀, 3 fois, une mue suivant la ponte. L'échelle de taille adoptée (largeur du 10<sup>e</sup> urotergite) varie de 10 à 52 dans nos élevages; les accroissements extrêmes après une mue sont de 0 et 8 unités; l'accroissement moyen étant de 3,5 unités on voit qu'un Japyx qui muerait régulièrement 2 fois l'an devrait vivre au minimum 6 ans.

**DATA ON THE PHYSIOLOGICAL BASIS FOR THE RHYTHMIC ACTIVITY OF FRESH-WATER MUSSEL'S LARVAE. János Salánki and Elemér Lábos, Physiological Institute of the Med. Univ., Debrecen and Biological Research Institute of the Hung. Acad. Sci., Tihany, Hungary.**

Nature and mode of regulation of rhythmic activity in invertebrate animals are in many respects unknown and controversial. As studies during ontogenesis provide new chances for approaching this problem, authors investigate the rhythmic function of the adductor muscle in larvae /glochidia/ of the fresh-water mussel, *Anodonta cygnea*. It was been investigated, whether their "spontaneous" rhythmic activity may be influenced by agents applied from outside: by different ions, biologically active substances and also various drugs.

It was found, that among the salts of ions examined /K, Na, Mg, Li, Rb, Cs/ KCl causes a striking rise /10-12 times/ of activity in concentration 1-2 mM, which lasts over 30 minutes. The same effect was caused by CsCl and LiCl /10 mM/. Higher concentrations of KCl cause a lasting tonic contraction of the embryonic adductor muscle.

Among biologically active substances, only tryptamine / $10^{-6}$  g/ml/ has proved to have an influence increasing activity, but serotonin, ACh and catecholamines had not a similar effect.

Among tested drugs hexamethonium, atropin, nicotine and TEA inhibit the activity-increasing effect of potassium, while TMA enhances it. The effect of tryptamine may be inhibit by chlorpromazine, iproniazid, and in some degree also by LSD.

The results show, that in the formation of the rhythmic activity of glochidia, external factors have an important role, and that at such an early stage of the mussel's ontogenesis tryptaminerg receptors play a role in its regulation mechanism.

AN ATTEMPT AT ANALYSING THE COURSE TAKEN BY THE PROCESS EXERCISED BY OVERCROWDING ON THE REPRODUCTION OF A POPULATION OF *CALANDRA GRANARIA* L. Henryk Sandner, Inst. of Ecology, Warsaw, Poland.

Tests carried out previously on the grain weevil showed that overcrowding as a factor reducing the reproductivity of a population did not act evenly. Experiments were made / $t=29^{\circ}\text{C}$ ,  $h=70\%$ / to analysis the course taken by the process of the inhibiting action of overcrowding on the grain weevil. In two series of culture vessels containing individuals of the weevil in optimum numbers and in intense overcrowding, the process of egg-laying was interrupted in successive vessels every three days. From the number of individuals of the succeeding generation in each vessel it was shown that under conditions of overcrowding the factual increase in population ends after about 15 days, whereas under conditions of optimum density it continued for over 100 days. In further experiments variations in degree of density during the culture period were applied, e.g. three populations of the grain weevil kept for 5 days under conditions of optimum density were combined in one vessel, thus forming conditions of considerable overcrowding for a further period. Vice versa, populations kept for 5 days in overcrowded conditions were separated, and kept for the further period of the culture in conditions of optimum density. These experiments confirmed the conclusion referred to above, that with the lapse of time the unfavourable effect of overcrowding intensifies, inhibiting to an increasing degree the development of the population. The effect of overcrowding during the first 5 days exerted a very inconsiderable effect on the above.

MAINTENANCE OF LARVAL TAPEWORMS (TAENIA CRASSICEPS) IN A CHEMICALLY DEFINED MEDIUM. Angela E. R. Taylor, Dept. of Biology, Queen Elizabeth College (University of London), London, W.8., England.

The larvae of Taenia crassiceps have survived for 33 days in Eagles medium and for the first 25 days showed healthy normal activity, produced acid metabolites and had an actively working flame cell system. The larvae increased to a length of 22 mm., appeared superficially to be miniature tapeworms and developed lateral excretory canals. The addition of 0.01% sodium taurocholate to the medium increased their maximum length attained in vitro to 27 mm.

Waymouths medium, NCTC 109 and Medium 199 did not support the larvae as well as Eagles medium, the maximum period of survival being only 16 days in these media.

Amino acids appear to be essential ingredients of Eagles medium and in particular the uptake of L-valine has been studied. Radioactive valine is taken up by the larvae very rapidly and appears to be actively transported into the larvae.



ORIGIN OF THE RHOPALOCERA STEM OF THE LEPIDOPTERA.  
Norman B. Tindale, South Australian Museum,  
Adelaide, Australia.

Studies of the patterns of tracheation in the wings of the newly formed pupa of the primitive Australian Hesperioïd butterfly (Euschemon rafflesia) have been in progress for some years. This butterfly is of interest because it retains in the male only, a frenulum, a feature which has been lost in all other Hesperioïds and is absent from the wings of all members of other families of the butterflies.

The forewing of the first day pupa of Euschemon shows a pattern in which the Sc trachea is present. The stem of ( $R_2 + R_3$ ) separates from  $R_1$  at about one-half but the stem ( $R_4 + R_5$ ) divides from the rest of R nearly at the base of the wing. There is thus a deep division between the two stems ( $R_2 + R_3$ ) and ( $R_4 + R_5$ ).

Studies of representative examples show that this feature is present also in early pupal stages of members of the higher families of butterflies.

The author therefore has been led to the conclusion that it is indicative of a very early specialisation in the wings of butterflies, and marks them off from other branches of the Heteroneurous stem.

The suggestion is that there is support for a view that the butterflies should be regarded as a separate branch of the Lepidopterous stem approximately equal in importance to the rest of the Heteroneura, and separate also from the Homoneura. For this subordinal group the term Schizoneura is proposed.

The author has drawn a hypothetical archetype for the Schizoneura basing it on features of the venation and of the tracheation which he has detected in the butterflies. While the Hesperioidea show more primitive characters than any other superfamily, other archaic features seem better preserved in the Pierioidea, and a few in the Papilionoidea.

МНОГООБРАЗИЕ ФОРМ ФИЗИОЛОГИЧЕСКОГО ПОКОЯ У НАСЕКОМЫХ, КАК  
ОДНА ИЗ ПРЕДПОСЫЛОК ИХ БИОЛОГИЧЕСКОГО ПРОГРЕССА. Р.С.  
Ушатинская, Институт морфологии животных им. А.Н. Север-  
цова АН СССР, Москва, СССР.

Изучение экологии диапаузы насекомых выявило большое разнообразие ее у разных видов, как по продолжительности и устойчивости этого состояния, так и по факторам вызывающим диапаузу и факторами, обуславливающим реактивацию организма (Andrewartha, 1952; Bodenheimer, 1952; Lees, 1955).

Анализ физиологических и биохимических особенностей зимней диапаузы насекомых, распространенных в зоне умеренного климата, позволил понять основные направления изменений метаболизма, типичные для этого состояния и уровень торможения обмена веществ.

У *Leptinotarza decemlineata* Say нами выделено четыре категории покоя разной глубины, продолжительности и биологической значимости: "летняя диапауза", "зимняя диапауза", переходящая с наступлением холодов в зимнюю спячку, "поздотворная диапауза" и "затяжная (многолетняя диапауза", сопровождающаяся исключительно глубоким торможением процессов базального метаболизма, с преобладанием анаэробных процессов (Ушатинская, 1958, 1961, 1962). Три различных типа физиологического покоя обнаружено нами в онтогенезе *Antheraea pernyi* G.M.; неустойчивое состояние характера кратковременной диапаузы летнего типа, зимняя диапауза и затяжная диапауза. Сложная не изученная диапауза имеется и у ряда других видов *Lepidoptera*.

Благодаря множественности типов физиологического покоя достигается многократная гарантийность выживания части особей вида при неблагоприятно складывающихся условиях внешней среды, на каждом отрезке года.

Vol. 1  
AUTHOR INDEX

- Abbott, B. C., 106  
Ábrahám, A., 289  
Aguilar, F. J., 144  
Allen, J. A., 103  
Amrein, Y. U., 127  
Anciaux de Faveaux, M., 149  
Andersen, F. L., 131  
Andrews, S. M., 177  
Arcadi, J. A., 84  
Arnold, J. M., 76  
Arvy, L., 146  
Atlavinite, O. P., 225  
Balogh, J., 237  
Bandy, O. L., 221  
Banfield, A. W. F., 206  
Ben-Tuvia, A., 115  
Berger, J., 122  
Berkson, H., 93  
Bernard, F., 117  
Berner, L., 290  
Beverley-Burton, M., 273  
Bidder, A. M., 71  
Bliss, D. E., 48  
Bock, W. J., 168  
Boden, B. P., 106  
Boggs, N., 186  
Boisson, C., 123  
Bonetto, A. A., 9  
Bosma, G. C., 274  
Bousfield, E. L., 201  
Brinton, E., 204  
Carayon, J., 145  
Carter, P. B., 131  
Ceï, J. M., 196  
Chabaud, A. G., 291  
Chetail, M., 41  
Choi, K. C., 39  
Clarke, A. H., Jr., 202  
Clarke, M. R., 67  
Clayton, L., 174  
Clegg, J. A., 83  
Collier, A., 57  
Comita, G. W., 50  
Comita, J. J., 50

Vol. 1 INDEX (cont.)

- |                               |                                  |
|-------------------------------|----------------------------------|
| Crisp, D. J., 58              | Fields, W. G., 72                |
| Crump, P. T., 186             | Finley, H. E., 186               |
| Dahl, E., 88                  | Fitzgerald, L. R., 275           |
| Damian, R. T., 77             | Folliot, R., 11                  |
| Darnell, R. M., 243           | Fontaine, A. R., 87              |
| Davenport, D., 59             | Force, D. C., 239                |
| Davis, H. C., 226             | Forneris, L., 234                |
| Defretin, R., 100             | Foster, N. R., 158               |
| de Haro, A., 46               | French, N. R., 258               |
| de Puytorac, P., 27           | Freudenthal, H. D., 21           |
| Dharmakumarsinhji, R. S., 214 | Gandhi, J. R., 185               |
| Dispons, P., 4                | Gans, C., 168                    |
| Ducoff, H. S., 274            | Geldiay, S., 6                   |
| Dulic, B., 266                | Gerschman de Pikelin, B. S., 194 |
| Dunn, F. L., 292              | Glass, B., 286                   |
| Echols, R. J., 221            | Godeaux, J. E. A., 16            |
| Ellenby, C., 139              | Godet, R., 276                   |
| Erspamer, V., 196             | Gonor, J. J., 43                 |
| Etcheverry, M., 191           | Goodbody, I., 113                |
| Ezzat, Y. M., 192             | Goodnight, C. J., 15             |
| Farmanfarmaian 18             | Goodnight, M. L., 15             |
| Feir, D., 5                   | Gösswald, K., 208                |
| Feuer, R. C., 197             | Gothoskar, S. V., 298            |

Vol. 1 INDEX (cont.)

- Gradwell, G. R., 240  
Gressitt, J. L., 216  
Grobman, A. B., 286  
Grodzinski, W., 257  
Grossu, A. V., 45  
Guttman, H. N., 32  
Hafez, M., 53  
Hall, E. R., 267  
Halton, D. W., 29  
Hamar, M., 293  
Hammond, D. M., 131  
Hanks, J. E., 227  
Harding, J. P., 147  
Hart, C. W., Jr., 51  
Havranek, L., 294  
Hedgpeth, J. W., 107  
Hendrix, G., 70  
Heyneman, D., 126  
Holland, F. D., 174  
Horváth, L., 295  
Hovasse, R., 27  
Hunter, A. S., 230  
Husson, R., 30  
Hyland, K. E., 152  
Ionescu, M., 215  
Ivanov Artemii, V., 97  
Jakowska, S., 81  
Jennings, J. B., 28  
Johnson, D. S., 246  
Johnston, R., 60  
Jolicoeur, P., 183  
Jones, A. C., 105  
Jovančić, L., 241  
Kampa, E. M., 106  
Kang, Y. S., 277  
Kasimov, G. S., 151  
Kaushiva, B. S., 125  
Kawaguti, S., 278  
Kevan, D. K. McE., 14  
Kielan-Jaworowska, Z., 173  
Kobakhidze, D. N., 209  
Kobayashi, M., 12  
Koford, C. B., 263  
Kohn, A. J., 188  
Kolosváry, G., 296  
Kühne, H., 228

Vol. 1 INDEX (cont.)

- |                       |                       |
|-----------------------|-----------------------|
| Kula, N., 169         | Madbouly, M. H., 53   |
| Lábos, E., 301        | Madsen, H., 143       |
| Laderman, A. D., 32   | Magnin, E., 195       |
| Lagerspetz, K., 279   | Maguire, B., Jr., 64  |
| Lang, B. T., 102      | Maillet, P. L., 11    |
| Lasker, R., 114       | Maramorosch, K., 3    |
| Laubier, L., 112      | Marcuzzi, G., 207     |
| Lee, J. J., 22        | Markevitch, A. P., 52 |
| Leloup, E., 26        | Martin, A. W., 78     |
| Leung, Y. M., 121     | Matsuda, R., 184      |
| Levi, C., 23          | Matsudo, H., 121      |
| Levine, E. P., 18     | Menon, M., 297        |
| Linn, I., 268         | Messenger, P. S., 239 |
| Llewellyn, J., 133    | Mettrick, D. F., 134  |
| Loosanoff, V. L., 98  | Miller, A. H., 166    |
| McAlester, A. L., 175 | Miller, R. R., 244    |
| MacClintock, C., 44   | Misra, A. B., 157     |
| McCullough, C. B., 25 | Mitsubishi, J., 3     |
| McGowan, J. A., 68    | Mody, J. K., 298      |
| MacInnis, A. J., 142  | Mohiuddin, A., 130    |
| McNeil, W., 242       | Mohr, J. L., 121      |
| Ma, T.-Y. H., 280     | Moment, G. B., 281    |
|                       | Naumov, N. P., 259    |

Vol. 1 INDEX (cont.)

- Nayar, K. K., 299  
Noble, E. R., 148  
Nørrevang, A., 33  
Norris, K. S., 248  
Oda, S., 35  
Okutani, T., 68  
Olney, P. J. S., 256  
Olson, E. C., 165  
Pagés, J., 300  
Pajarskajte, A. I., 225  
Panchen, A. L., 161  
Panigel, M., 282  
Patton, W. K., 104  
Peakall, D. B., 13  
Pearcy, W. G., 69  
Pearse, J. S., 111  
Pederson, K. J., 82  
Petitjean, M., 187  
Petrusewicz, K., 233  
Phillipson, J., 238  
Pierce, S., 22  
Pipkin, A. C., 128  
Pipkin, S. B., 231  
Pitelka, F. A., 265  
Poljansky, G. I., 219, 220  
Poll, M., 160  
Poole, L., 169  
Possompés, B., 10  
Potts, W. T. W., 78  
Povolný, D., 260, 261  
Provenzano, A. J., Jr., 49  
Radu, V. Gh., 189  
Renaud-Debyser, J., 224  
Richard, G., 8, 283  
Robson, E., 61  
Rodriguez, R. L., 231  
Ross, D. M., 62  
Rossi, J., 284  
Ruibal, R., 163  
Runham, N. W., 42  
Sabbadin, A., 17  
Salánki, J., 301  
Salthe, S. N., 162  
Salvat, B., 224  
Samuels, R., 129  
Sandner, H., 302

Vol. 1 INDEX (cont.)

- Saxena, K. N., 185
- Scaglia-de-Paulete, S., 159
- Schad, G. H., 223
- Scheltema, R. S., 63
- Schiapelli, R. D., 194
- Schlieper, C., 40
- Schmid, W. D., 248
- Schreiber, B., 94
- Schwarz, S., 262
- Secretan, S., 47
- Segal, E., 85
- Seshachar, B. R., 185
- Sharma, G. D., 14
- Shepro, D., 169
- Short, R. B., 77
- Shulov, A., 150
- Sierra-de-Soriano, B., 159, 250, 251
- Smith, R. I., 101
- Smith, S., 155
- Smoker, W. A., 245
- Sokolov, W., 167
- Soong, M. H. H., 246
- Soriano-Señorans, J., 251
- Southward, A. J., 96
- Southward, E. C., 96
- Steeves, H. R. III, 89
- Stoll, N. R., 124
- Stroun, J., 284
- Stroun, M., 284
- Stroun-Guttières, L., 284
- Stunkard, H. W., 132
- Sutton, L., 62
- Svetovidov, A. N., 212
- Swartz, L., 255
- Szarski, H., 156
- Tamura, T., 116
- Tatarinov, L. P., 178
- Taylor, A. E. R., 303
- Taylor, R. E., 86
- Terbush, L. E., 152
- Test, F. H., 247
- Thorson, T. B., 164
- Tindale, N. B., 304
- Tschudinov, P., 180
- Tuthill, S. J., 174
- Uchida, T., 24



Vol. 1 INDEX (cont.)

- |                                 |                          |
|---------------------------------|--------------------------|
| Underhill, J. C., 248           | Waters, J., 205          |
| Urry, D. L., 95                 | Weinmann, C. J., 135     |
| Ushatinskaya, R. S., 305        | Welch, B. L., 269        |
| Vandebroek, G., 179             | Welch, H. E., 140        |
| Vannucci, M., 222               | Wells, G. P., 203        |
| Varley, G. C., 240              | Westoll, T. S., 176, 177 |
| Vaz-Ferreira, R., 159, 250, 251 | Wiegert, R. G., 232      |
| Velasquez, C. C., 136           | Willmott, S., 141        |
| Viereck, E. G., 264             | Wood, F. G., Jr., 73     |
| Vivier, E., 31                  | Wood, R., 93             |
| Voss, G. L., 74                 | Woodley, J., 34          |
| Vovelle, J. L., 99              | Woolley, T. A., 193      |
| Vuillaume, M. P., 7             | Yakhontov, V. V., 229    |
| Wallwork, J. A., 210            | Young, R., 75            |
| Walz, M. A., 5                  | Zinn, D. J., 93          |
| Wang, Y.-H. M., 211, 285        | Zullo, V. A., 190        |